FOUNDRY TRADE JOURNAL

Established 1902

Vol. 97 Thursday, October 21, 1954 No. 1990

PRINCIPAL CONTENTS

	PAGE
Features	
Leader: Food for Thought	465
Conference Paper Authors	466
House Organs	466
New Catalogues	480
Notes from the Branches	489
Forthcoming Events (Advert. section)	33
Technical	
Die-pressing of Gutters, by R. S. M. Jeffrey and J. A. Richards	467
Institute of Vitreous Enamellers	478
Theory, Economics and Practical Application of Exothermic Materials—Discussion	481
News	
Our Change of Address	466
Geneva Meeting of I.L.O. Iron and Steel Committee	477
Growing Importance of Oil	477
Factory Acts Offences	477
Smoke Pollution at Stourport	488
B.S.I. Information	488
"Allied" Group Changes	488
Company News	489
Personal and Obituary	490
News in Brief	492
Raw Material Markets	496
Statistics	
Latest Foundry Statistics	480
Current Prices of Iron, Steel and Non-ferrous Metals (Advert. section)	32

PUBLISHED WEEKLY: Single Copy, 9d. By Post 11d. Annual Subscription, Home 40s. Abroad 45s. (Prepaid).

49 Wellington Street, London, W.C.2. 'Phone: Temple Bar 3951 (Private Branch Exchange) Grams: "Zacatecas, Rand, London"

Food for Thought

Recently, we visited the most beautiful foundry we have ever seen. Its *decor*, its ventilation, heating, lighting and amenities were as good as modern engineering and ample finance could make them. Yet this magnificent workshop set us wondering as to whether the construction of bigger and better workshops is the be-all and end-all of manufacturing progress. We recall that the late Henry Ford himself had some doubts on the matter, for he created some quite small-scale industries in a garden city. The influence of the very large workshop is difficult to assess, yet conversely a couple of men having a small shop in which to work, seem to acquire a proprietary interest in their surroundings and carry on splendidly with a minimum of control.

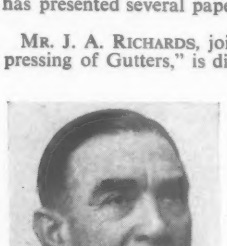
Two leading scientists in our industry at one time worked together in a very large research laboratory replete with every facility a scientist could want. Yet they migrated to a cubby-hole over some outbuildings. No very sound reason was forthcoming for this removal except that they worked better there! They were sufficiently important that there was no question of adding to their status, yet under other conditions this may well be an important factor. A modern factory system may be so perfect, that a desk or table on the shop floor would be ample for taking care of the foreman's paper work. Still, we should be the last to suggest he should be robbed of his office, for now that his bowler hat has gone, it is his last insignia of authority.

We are well aware that the small isolated workshop is inconsistent with modern conceptions of manufacturing processes, as it increases transport costs and general overheads. Yet despite this, we are convinced that if a foundry concern embraces some small ancillary processes within its scope, a small separate shop should be provided, and reliable men engaged who will work well without anything more than occasional supervision. As a theory operating against the efficiency of a large shop which utilizes many different kinds of skills, it is obvious that some operations must involve discontinuous working. This may be due to the onerous character of a job or periods of waiting between the actual performance of some essential skill. Such a delay possibly or probably has an influence on those nearby whose work could be carried out continuously. However, there may be other reasons equally plausible to account for an atmosphere distinctly unfavourable to very large shop floors. Conversely, the two men working in a small department, under virtually no control, work better and seem happier than their mates in the large shop, despite all the modern amenities provided. These thoughts should not be taken to mean that we are in favour of anything but the best possible working place; they merely record an impression that conditions bordering on the palatial do not always produce optimum results. We think it equally important that each operator should be provided with adequate working space in which he can identify himself, not only with his immediate job, but also with whatever else goes on to the limit of his vision. If the location and surroundings of a working area are such as to inculcate a feeling of "being alone in a crowd," then output both in quality and quantity is liable to suffer.

Conference Paper Authors

MR. R. S. M. JEFFREY, B.SC., F.R.I.C., joint Author of the Paper "Die-pressing of Gutters," printed in this issue is a director of Federated Foundries, Limited. Educated at the Royal Technical College, Glasgow, and the University of Glasgow, he graduated in 1925. His early foundry training was at the works of Cameron & Robertson, Limited, Kirkintilloch. On the formation of the Federated Foundries group, with which Cameron & Robertson, Limited, are associated, he joined the parent company as chief metallurgist. In 1950, he was appointed director of technical development and in 1952 became a full director. During the 1939-45 war period he was responsible for electric steel production, both acid and basic, also aluminium-alloy production. He has studied production methods of light castings both in the U.S.A. and elsewhere. Mr. Jeffrey joined the Institute of British Foundrymen in 1926 and has presented several papers.

MR. J. A. RICHARDS, joint Author of the Paper "Die-pressing of Gutters," is director and manager of Walter Macfarlane & Company, Limited. He was educated in London and at Halifax Technical College as an engineer. His first interest in the foundry industry was in non-ferrous die castings. In 1929 he joined the Crane Foundry Company, Limited, of Wolverhampton as assistant general manager, and was appointed a director in 1943 and was managing director until 1947. During this time he was responsible for mechanizing the foundry and the complete modernization of the plant. He was a member of the B.C.I.R.A. light-castings committee (English section) from its inception until 1947. He joined the Institute of British Foundrymen in 1938 as a member of the Birmingham branch.



House Organs

The Stantonian. Vol. 19, No. 2. (August). Issued by the Stanton Ironworks Company, Limited, near Nottingham.

Deservedly, this issue devotes much space to recalling the outstanding activities of the late Mr. P. H. Wilson, for he was so conscientious in his participation in the widespread activities of the personnel of the company, to which the current issue clearly testifies.

Malleable Facts. No. 49. Issued by the Malleable Founders' Society, Union Commerce Building, Cleveland 14, Ohio.

This issue "stars" the Susquehanna River Bridge, at Havre de Grace, Maryland, claimed to be the most beautiful in the world, because malleable castings were used in its construction. An excellent example is given of a case where malleable iron has replaced a welded structure with a saving of 31 per cent. in cost.

The Iron Worker. Summer, 1954. Published by the Lynchburg Foundry Company, Lynchburg, Virginia, U.S.A.

This issue contains two very interesting articles—one on the Shenandoah National Park and the second on the industrial development of Virginia. In connection with the latter it is stated that the Lynchburg Foundry is spending about £400,000 on a new shell-moulding foundry, which is to be completed this year. The article dealing with the actual works covers the new handling facilities which have recently been installed.

Aluminium Courier. No. 26. Issued by the Aluminium Development Association, 33, Grosvenor Street, London, W.1.

This issue is of great general interest, as it deals with sports equipment made of aluminium components. The range embraces cricket, hockey, football, golf, swimming, tennis, fishing, field sports, equitation and fencing. The last part of the issue covers toys for the nursery.

IN THE CATALOGUE of exhibitors in the British Pavilion of the Iznair International Fair (which has been organized by the British Chamber of Commerce (Inc.), Yosifidis, Han, No. 9/11 Asisefendi, Caddesi, Istanbul), it is pleasing to find, not only names which are outstanding in British industry, but also firms of modest size. There were over 150 stands with an average of about six firms to each, and from this can be gathered the wide appeal this fair has made.

Please note our change of address:

With effect from October 25, the offices of the FOUNDRY TRADE JOURNAL will move from 49 Wellington Street, London, W.C.2. to :—

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Die-pressing of Gutters*

By R. S. M. Jeffrey, B.Sc., F.R.I.C. and J. A. Richards

"Necessity is the mother of invention"—and the development of the die-pressing process for iron castings proves to be no exception to this over-ruling maxim. Thus, in the introduction to the Paper the motives leading up to the adoption of machine casting and the limiting factors are first outlined, and followed by an account of early experiments. Next, the machine, its modus operandi *and control features are dealt with in detail. Finally, the die-pressing process is fully described and metallurgical aspects of this new method of manufacture are commented upon.*

Development

It was realized in 1945 that it would be difficult for the foundry industry to supply the cast-iron gutters required for the post-war housing programme because of the number of moulders who had left the trade during the war years and who showed no sign of wanting to come back to their old jobs. As this was a particularly large part of the trade of Federated Foundries Limited it was necessary to find alternative means of production. Naturally, in common with many other foundries suffering from similar trouble thoughts turned to mechanized sand moulding. On investigation, this did not appear to be an economic proposition, because of the high capital and running cost of the plant to handle a very large volume of sand for a comparatively small output—in tonnage—of castings. To increase the tonnage the possibility of making two gutters in the form of a pipe and leaving slots along the joint so that they could be separated was considered. This was not a success.

It will be understood, no doubt, that cast-iron gutter has one of the lowest selling prices of any iron casting and in addition it is expected to be straight and to be easily cut with a hacksaw. At that time (1945), and in fact until last year, the selling prices were controlled on the basis of 1939 prices plus an authorized increase which did not allow one to consider anything but the very cheapest production methods and eliminated all possibilities of adding an annealling operation to the production cost unless the cost of such an operation could be more than saved elsewhere.

Initial Experiments

Experiments were then carried out in casting in permanent moulds, but as expected not only were the castings white but they fractured in many places. To overcome these difficulties two things were essential:—(*a*) the gutters must be removed from contact with the mould almost immediately after casting to eliminate the chilling effect, *i.e.*, permit graphitization after solidification and (*b*) down-gates must be dispensed with, as these prevented contraction and caused fracturing. How could these requirements be met? The only solution which appeared to the Authors to meet them was a displacement casting process utilizing fast-moving dies. It was then decided to try pressing out the gutter by the process now about to be described.

The initial trials were made on a short length of plain, half-round gutter omitting the faucet end as it was thought this would raise unnecessary complications at the outset. The die assembly was very simple—just two halves hinged together with a handle on the top die for operating purposes. The dies were first coated with one of the ordinary washes used in the foundry for coating chills, preheated and metal poured in. Quite a reasonable result was achieved. It was found that under certain conditions of timing, soft, grey castings were obtained and also that, at least on this short length, fracturing could be avoided. Having been successful in meeting the initial requirements, the firm was encouraged to pursue the possibilities of the process. Further trials led to the appearance of:—

(*a*) "*Boiling*" of the metal in the die, producing spongy areas in the casting. When castings were made repeatedly, the coating on the die was removed, particularly where the metal impinged on the die. Re-coating of the hot die by painting or spraying was not very successful.

Superimposing a film of carbon on the original coating was therefore tried in a manner similar to that adopted in the Holley process for iron die-castings. This gave the desired result.

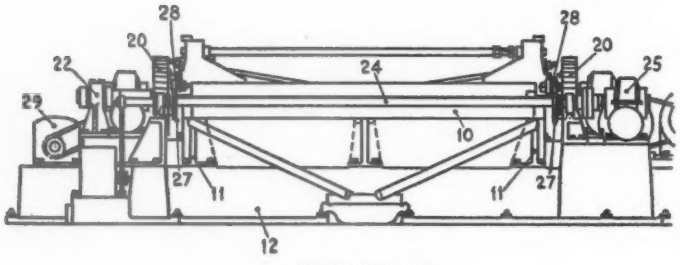
(*b*) "*Splashing*". Too fast a movement of the male die when in contact with the metal displaced the metal completely from some areas of the mould, with disastrous results. Conversely too slow a movement permitted solidification before the dies were completely closed. It was evident that fairly close control of metal fluidity, both as to temperature and composition, the temperature of the dies and the timing of each stage of the operations was essential.

(*c*) *Slag inclusions.* From the nature of the process it was obvious that no slag trap could be provided and that it would be essential to pour 100 per cent. clean metal.

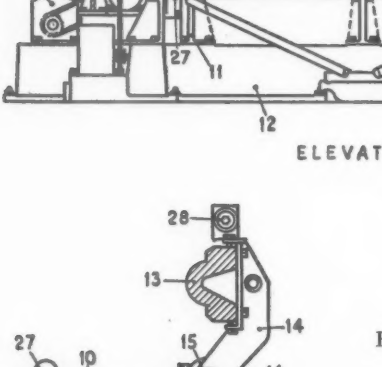
From experimental observations on this first set up, the management went ahead with using larger dies and finally attempting a full 6-ft. gutter. As the length increased and also the speed of operation, other problems arose, particularly these:—

(1) *Overheating of the dies.*—Where previously die heating during casting had been provided it was now found necesary to introduce cooling, first

* Presented at the Glasgow annual meeting of the Institute of British Foundrymen.



ELEVATION



END VIEW

FIG. 1. — *Diagrammatic front view of the die-pressing machine and sectional end view, with dies in the "open" position; (for key see text).*

on one, then on both dies. Thermocouples were introduced at various points on both dies and cooling means were established to maintain the optimum temperature over both die faces.

(2) *Bending of both dies and castings.*—Dealing first with the dies it was found that the fixed or female die could be held to shape by fixing it to a substantial base, a sliding contact being provided to take care of linear expansion. The moving or male die posed a more difficult problem in this respect, but a system of tie-rods was incorporated which appeared to provide an answer and it will be later described how these were ultimately developed.

That difficulty could be encountered in obtaining a completely straight casting was fully realized. The necessity for providing camber and set on floor patterns was known, *i.e.*, that a *bent* pattern was necessary to produce a *straight* casting. However, by combining with the pressing machines a subsequent operation of clamping this difficulty was overcome. Incidentally this clamping machine as well as assisting in producing gutters straight has served a further purpose in the final plant as will be seen later.

Having established the process, the next problem was to make it a satisfactory production job. This was largely a question of engineering design to overcome the problems arising when working machines at high temperatures and at a high production rate.

Machine Description

In the early experiments a die 3ft. long was used. This was hand operated and all operations were controlled by an observer calling times from a stopwatch. It was soon realized that before a 6-ft. die could be made to work satisfactorily the machine would need to be power operated and an automatic and more accurate means provided to control timing.

The first consideration was that the weight of the male die (the moving one) would be about 4½ cwts. Secondly, this die would need to travel from the wide-open position to a point just above the level of the molten metal in the female die in about 2 sec. It would then require to stop and continue at a controllable rate until the dies were fully closed. Thirdly, the location of the two dies relative to each other would need to be very accurate. Taking all these points into consideration, it was decided to use an electrically-operated machine, with a suitable control panel incorporating electric timing devices. It was also decided to use a pivoted male die and a cam device for controlling the closing operation from the time this die arrived at a point just above the molten metal in the female die.

Essentially the machine itself is quite simple—the complicated part is the electrical control panel which will be described later. Fig. 1 shows a diagrammatic front view of the machine and a sectional end view—the dies being in the open position. The female die (10) is mounted on a base (12) supported by three stools (11). The male die (13) is carried by two radius arms (14), which are pivoted at a point (15) in the bracket (16) which is supported from the base (12). Cam rollers (28) are shown extending from the radius arm. The camshaft (24) is shown at the front of the machine, together with its reduction gear (25) and d.-c. variable-speed driving motor (26).

Thus Fig. 2 shows the operation of the camshaft, (*a*) showing the cam in its "up" position receiving the cam rollers mounted on the radius arms just before the male die contacts the metal contained in the female die. The lower sketch, (*b*), shows the cam in its "down" position—after having left the cam rollers on completion of the die-closing movement. Fig. 3 shows the arrangement of the driving arms, reduction gears and motors. The radius arms only act as guides. The movement of

Die-pressing of Gutters

the male die is performed by two driving arms (23) —one at each end of the die—connected to spur gears (20) which are driven, through reduction gears, by separate electric motors at the rear.

Design Factors

It should perhaps have been mentioned earlier that the design of the machine was controlled to a great extent by the pouring arrangements found necessary. Owing to the shape of a half-round gutter, it was soon found that metal could only be poured into the die in the direction of the longitudinal axis. Otherwise the metal immediately ran up the far side and straight out of the die. This made it necessary for the top die to open through about 90 deg., in order to get a suitable size of hand-ladle into position for pouring. Also at times it is necessary for the top die to be open as nearly as possible through 180 deg. for cleaning and inspection purposes.

As will be appreciated, these dies become very hot, the main effects of the high temperature being distortion and expansion. Owing to the rigid construction of the base and stools it was possible to control the distortion of the bottom die and at the same time allow it to expand in one direction from a fixed point—usually the right-hand end of the die. To control distortion of the top die was not so easy, as, of course, it was more or less floating. A bend of up to one inch may occur. This was overcome by a superstructure fitted on the top die comprising a system of tensioning bars to apply stress where necessary to combat distortion.

Expansion, which could amount to a difference of nearly $\frac{1}{2}$ in. between the lengths of the two dies was overcome by making allowance in the construction of the dies and also providing an adjustment in the bearing in the bracket (16) so that the relative position of the two dies could be altered as required.

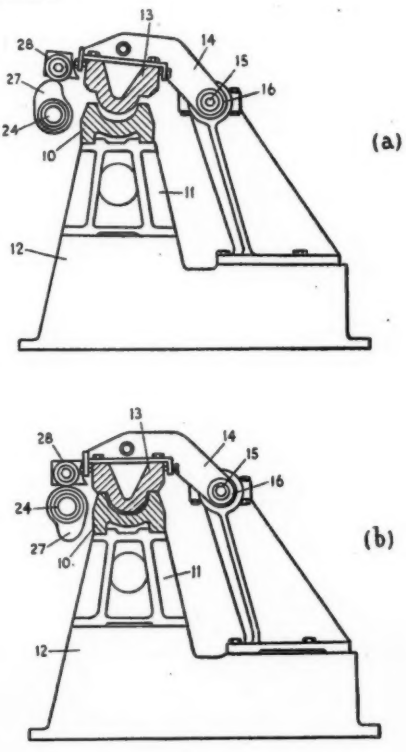
Power Features

The power required for operating the machine is not great, as the molten metal in the dies is only displaced to shape the gutter; the weight of the moving die being ample to provide the force and pressure necessary. The size of the motors (4 h.p.) was determined more from consideration of the weight of the moving die and the torque necessary for raising it. In the closed position, the motors provide some pressure additional to the weight, which is found to be an advantage in preventing excessive phosphide extrusion. As previously mentioned in the account of our experimental work, it was found that the rate of closing the dies after the male die had entered the molten metal in the female die was very critical. It depended on the temperature of the dies, the temperature of the metal, the composition of the metal, and the thickness of the gutter. If the conditions were not relatively correct a fast closing caused the displaced metal to run out too quickly and leave gaps in the edge of the gutter and a slow closing caused the metal to solidify before the dies were completely closed, resulting in a heavy casting. To overcome this, a cam was designed to control the closing of the dies to give approximately a uniform rate of displacement and incorporating a means of providing a very wide speed variation. It was also arranged that the cams left the rollers on the radius arms when the dies were fully closed so that the full pressure of the top die together with the power from the motors could be applied to the casting during solidification.

Although not shown on the diagrams, there is a cooling system arranged to supply air draught to the underside of the female die and the top side of the male die. This is necessary in order to achieve the high production rate of a gutter—approximately one every 90 sec.

In conjunction with each pressing machine, a clamping device is operated as previously mentioned. After the gutter has been pressed out, it is manually lifted from the female die and placed in the clamping device where it cools off during which time an operator knocks off the flash formed at the joint face of the dies. As will be described later under the description of the electrical controls, it was found necessary to indicate a minimum time before the operators were allowed to remove the casting from the female die. It is generally accepted

FIG. 2.—*Operation of the camshaft (a) with the cam in the "up" position and (b) in the "down" position.*



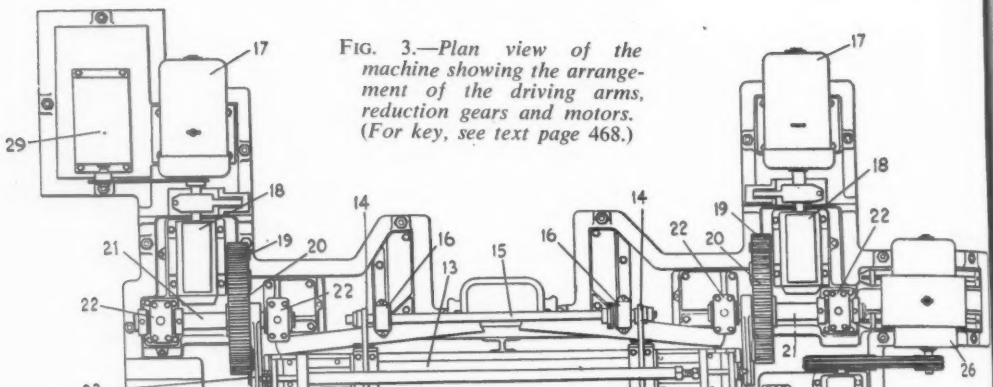


FIG. 3.—*Plan view of the machine showing the arrangement of the driving arms, reduction gears and motors.* (*For key, see text page* 468.)

FIG. 4.—*Basic diagram—to be considered in relation to Fig. 3—of a complete cycle, from which timing controls were determined.*

that cast iron cannot be forged but cast iron at the temperature at which the dies open is in a very malleable state and much distortion can be caused by premature handling of the newly-pressed casting.

Dies

All dies are cast in a suitable grade of Meehanite in the foundry of an associated company, Cameron & Roberton Limited of Kirkintilloch. They are completely machined and fitted up in the firm's own die-making department at Saracen Foundry. On an average, about 40,000 castings are obtained from a set of dies. In exceptional cases there have been 60,000. The female dies usually go right through a programme without repair, but the male dies burn away at the corners at each end. These ends are made as loose parts which are replaced as required. In addition it is advantageous to have a loose end-block at the faucet end of the die as this facilitates the machining of the form in the die. Generally speaking, experience of die life is far better than was originally estimated.

Machine Controls

So far, the description given has dealt with the mechanical details of the machine. However, it may be interesting to some to have a description of the electrical side, particularly the controls employed. It was necessary to design a control system which would:—

(1) Move the male die down to a point just above the level of the molten metal in the female die in the shortest possible time—say 2 sec. maximum.

(2) Reduce the speed of the male die so that it could be variable and complete the closing of the dies in anything up to 10 sec.

(3) Allow a definite (although controllable) time to elapse before opening the dies and returning the male die to its original position.

(4) Provide a safety arrangement so that the male die could not enter the metal in the female die at an uncontrolled speed.

(5) Give indications, by means of lights, to the operator, of the time when the pressed casting should be removed from the female die and when another casting could be made.

Fig. 4 (considered in relation to Fig. 3) gives the basic information of a complete cycle from which these controls were determined. From its normal "open" position, OA, lying at an angle of approximately 80 deg. to the horizontal, the die has to move to position OB, at which position the lowest point of the male die is just clear of the metal in the female die. From position OB, the male die must proceed at a controlled rate to its fully-closed position at OC, in which it must remain under pressure for a given interval of time before returning to its normal "open" position, OA. To drive the die, two reversing 4-h.p. a.-c. 960 r.p.m. slip-ring motors (17) are employed, coupled through gearing to each end of the die. Each motor is equipped with an electro-magnetic brake. In order to avoid twisting of the die, both ends have to move in absolute unison and therefore two motors, which will be called the "die motors" had to be specially made. To control the rate of movement of the die from position OB to OC, the variable-speed camshaft (24) is used and arranged so that, at position OB, rollers on the radius arms to which the male die is fixed make contact with the cams on the camshaft. Having reached this position, the die motors continue to drive the die down, the speed of

movement being then restrained and determined by the cam movement. For safety purposes, in order to avoid the possibility of the die motors driving the die down with the cams out of position, a suitable electrical interlock is introduced which makes it impossible for the die to move down unless the cams are in their correct positions. To drive the camshaft, a 1 h.p. d.-c. variable-speed motor, termed the "cam motor," is employed. It has a speed range of 5 to 1, and is coupled to the shaft through vee-belts and worm reducing gears.

Having reached position OC, the male die has reached the limit of its downward travel and remains in this fully-closed position, with the die motors (stalled) maintaining full pressure, for a given interval of time which will be referred to as the "solidification time." After completion of the "solidification time" the two die motors immediately reverse and return the male die to its normal open position, OA. Although the die has returned to position OA, the casting is not yet ready for removal from the die and, therefore, an indication is given by signal light to the operator (lift out) of the moment when to lift the casting out of the die.

A further point of importance is that once the casting has been removed from the die a further interval must elapse before a new cycle can be commenced, this interval being required to permit the die temperature to stabilize and to allow for the treatment of the die surfaces in readiness for the next operation. At the end of this interval, a second signal, termed "new cycle," is given for the operator to begin the next cycle.

Electrical Control Mechanism

From the foregoing it will be appreciated that the controlling of die movements, the introduction of safety interlocks and the provision of the "solidification time," "lift-out time" and "new-cycle time" signals introduce some difficult problems. Slip-ring-type die motors were chosen to serve two purposes, (*a*) to drive the die, and (*b*) to produce any necessary pressure between the male and the female dies. These motors produce the desired pressure when stalled, without being in any way overloaded.

The choice of a d.-c. motor to drive the camshaft was made on account of the ease and economy with which the relatively wide speed range of 5 to 1 could be obtained. Fig. 5 shows the control panel with front door open. In order to keep to a minimum the number of operations required and to reduce the degree of skill on the part of the operator, it has been arranged that the depressing of a single push-button labelled "cycle" sets the machine in motion and a complete operational cycle is carried through under the action of automatic contactor gear and control relays, without further aid from the operator. Pressing of the cycle button sets both the die motors in motion simultaneously to drive the male die down.

In order to minimize the shock of impact of the die rollers on the cams the downward movement of the die is interrupted just before the rollers strike the cams and the die comes momentarily to rest with the rollers about one inch away from the cams.

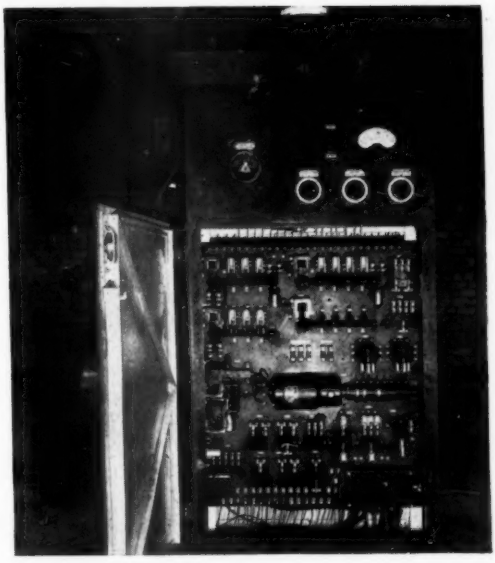


FIG. 5.—*Electrical control panel for the die-pressing machine, with the front door open.*

After a pause of about one second, the die resumes its downward journey and contacts the cams, which until that moment have been stationary. Simultaneously with the contact of the die rollers on the

FIG. 6.—*Application of the soot coating on the dies by means of an acetylene flame.*

FIG. 7.—*Modern cupola-charge preparation in drop-bottom buckets and push-button hoisting.*

cams, the cam motor starts up, the camshaft revolves and controls the male die until it comes finally to rest in the fully-closed position. When this point has been reached, the die rollers are clear of the cam and the camshaft continues to run until it has completed exactly one revolution. The die motors continue to be connected to the supply under stalled conditions for a pre-set interval of time after the male die has reached this fully-closed position, so that pressure is thus maintained during the solidification period.

After the elapse of the solidification time the die motors automatically reverse and return the die to its normal open position. Simultaneously with the elapse of the solidification time and the reversal of the die motors, the timing mechanism within the control panel starts on its second pre-set timing interval, namely the "lift-out time" interval, at the expiry of which a lamp signal is given to the operator to lift the casting from the die. At the instant of completion of the "lift-out" interval, the timing mechanism again changes speed and continues to run until the expiration of a third pre-set interval when the "new-cycle time" is shown by a second indicating lamp. The operator then takes metal for his next operational cycle.

As will be seen from the illustration, all speeds are adjustable from the front of the housing. The hand-wheel seen on left-hand side operates a compound regulator and controls the speed of the cam motor. All other timings, namely "solidification time," "lift-out time" and "new-cycle time," together with the actual sequence operation of the various contactors and relays are controlled from a master control drum shown in the centre of the control panel and driven by means of a small pilot motor. The three smaller control knobs each operate a toroidal rheostat mounted within the housing, these rheostats all controlling the speed of rotation of the control drum. The rheostat on the left of the group of three is in circuit during the solidification time and can be pre-set at any value between 3 and 10 sec. The centre rheostat is in circuit during the "lift-out time" and can be pre-set at any value between 10 and 30 sec. The rheostat on the right is in circuit during the "new-cycle time" and can be pre-set at any value between 0.5 and 3 min. Mounted remotely from the control panel are the indicating lamps, the cycle button and also "inching" buttons for the die and the camshaft for use during maintenance periods.

Process

Although a brief description of this process appeared in the FOUNDRY TRADE JOURNAL of October 8, 1953, it is now possible to give greater detail. The foregoing description of the machine and its controls makes the mechanics of the process quite clear and it is proposed to follow with a more detailed account of the operations and metallurgical side.

A first step is to provide the working faces of the dies with a protective refractory dressing. A thin

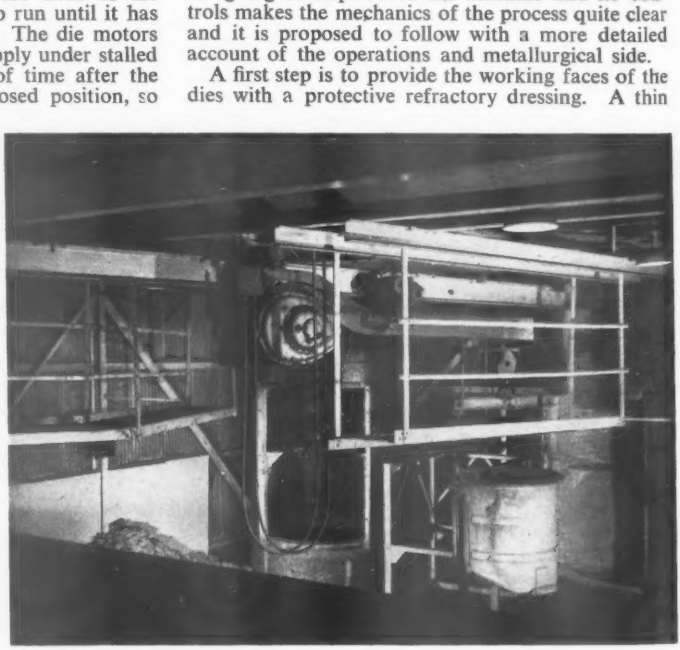


FIG. 8.—*Automatic delivery of the charge bucket to one of the pair of cupolas and drop-bottom release.*

FIG. 9.—*Drum ladles used for transporting molten metal from the cupolas to the machines.*

paste of silica flour and clay is applied by means of a spray-gun to a uniform thickness, and the dies are then heated. This heating is primarily for the purpose of thoroughly drying out the dressing. However, depending on the shape and section thickness of the casting a certain die temperature is necessary for successful pressing. In the case of the gutter casting, the dies are heated to above 200 deg. C. before commencing operations. In addition to the refractory dressing, before each pressing is made, an insulating coating of lampblack is applied by means of an acetylene torch. This latter coating serves to protect the dressing which only occasionally requires repair during a working shift. The application of a carbon coating in the Eaton-Erb gravity-die process for iron castings is well known, and in this pressing process it serves a similar purpose. Fig. 6 shows the lampblack being applied.

Metal Control

It is essential that the fluidity and "life" of the metal poured be controlled within fairly close limits, as any changes required in the machine controls to accommodate metal variation interrupt production. Modern cupola equipment, as shown in Figs. 7 & 8, has been installed to give the necessary metal supply, and this incorporates a yard crane equipped with a selective lifting magnet, metal weigh-hopper, transfer car, automatic drop-bottom bucket charger, and water-cooled spark arrestors fitted to the cupolas. A suitable metal composition for this type of casting has been found to be T.C. 3.3, Si. 2.6, P. 0.8, Mn. 0.5, S. 0.1 per cent. (maximum). The temperature of the metal (taken in the die) is over 1,300 deg. C. Precautions are taken to ensure that

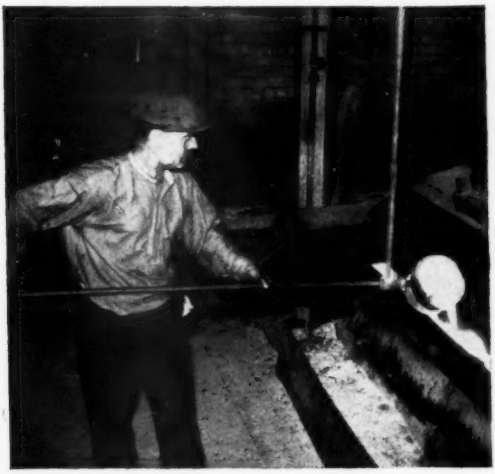


FIG. 10.—*Pouring metal into the female die from a suspended hand ladle, which incorporates a "teapot" spout.*

only "clean" metal is poured, the drum ladles used for transferring the metal (Fig. 9) and the hand ladles being provided with teapot spouts (Fig. 10). This view shows the pouring operation.

Observation of the liquid metal in the female die showed that, under certain conditions, slag is formed in the die. When molten cast iron is in contact with air the constituents of the iron may be oxidized by the following reactions:—

$$C + O = CO \qquad Mn + O = MnO$$
$$Si + 2O = SiO_2 \qquad Fe + O = FeO$$

These reactions do not take place at random,, but certain reactions take place preferentially at certain temperatures. When carbon is oxidized the product is gaseous and escapes, and does not contaminate the surface of the metal, but the oxidation of the other constituents gives a solid or a liquid slag-like material. This slag forms on the surface of the iron and may be reduced by the carbon in the iron, depending on the temperature of the iron, according to the following reactions:—

$$SiO_2 + 2C \rightleftharpoons Si + 2CO$$
$$MnO + C \rightleftharpoons Mn + CO$$
$$FeO + C \rightleftharpoons Fe + CO$$

Each of these reactions is reversible, tending to the right at high temperatures and to the left at low temperatures. Above a certain temperature, which is characteristic for each composition, they proceed entirely to the right, and any oxide or slag originally on the surface of the metal is reduced by the carbon of the melt, giving carbon monoxide, and returning silicon, manganese or iron to the melt. Under these conditions the surface of the melt rapidly becomes clear.

Surface Slag

The temperature at which the surface will remain clear is dependent on the metal composition, and,

FIG. 11.—*View of the machine at the stage, after pressing, when the die opens and the operator awaits the signal to remove the casting.*

obviously, the higher the silicon and manganese contents of the metal the greater will be the amounts of SiO_2 and MnO in the slag film. These elements are therefore kept to a minimum, having regard to their other necessary functions, and the temperature of the metal up to the time of pressing is maintained over 1,300 deg. C. This explanation of slag formation is very fully discussed by R. W. Heine in his paper on "Oxidation/Reduction Principles controlling the Composition of Molten Cast Iron."[1] By these means, slag on the metal surface is kept to a minimum, but in addition, immediately before pressing, the operator quickly skims the surface.

The cycle button having been pressed, the machine then operates on its controlled time-cycle, displacing the metal to the shape determined by the dies, remaining closed only for the time necessary for solidification, then quickly opening. As described under "control" each of these items is preset and carefully regulated. In order to produce a grey casting, free from chill, the maximum time the dies may remain closed is determined by the casting section and the control mechanism for "solidification time" is set accordingly. The dies having opened (Fig. 11) the casting then cools slowly and the signal lights indicate to the operator when to remove the casting and when a new cycle of operations can be commenced. The speed of operation is assisted by means of cooling system on both dies.

Properties of Castings

Physical and structural examinations have been carried out on two types of gutter—test-pieces being cut from the actual castings—with the following results:

Physical Tests:

	Dimensions of Test-piece.		U.T.S. tons per sq. in.	B.H. N.
	Width.	Thickness.		
Type "A"—1 ..	0.482	0.184	16.7	243
2 ..	0.444	0.157	18.3	265
3 ..	0.473	0.201	17.5	261
Type "B"—1 ..	0.551	0.118	21.5	270
2 ..	0.552	0.136	20.9	267
3 ..	0.540	0.140	21.5	265

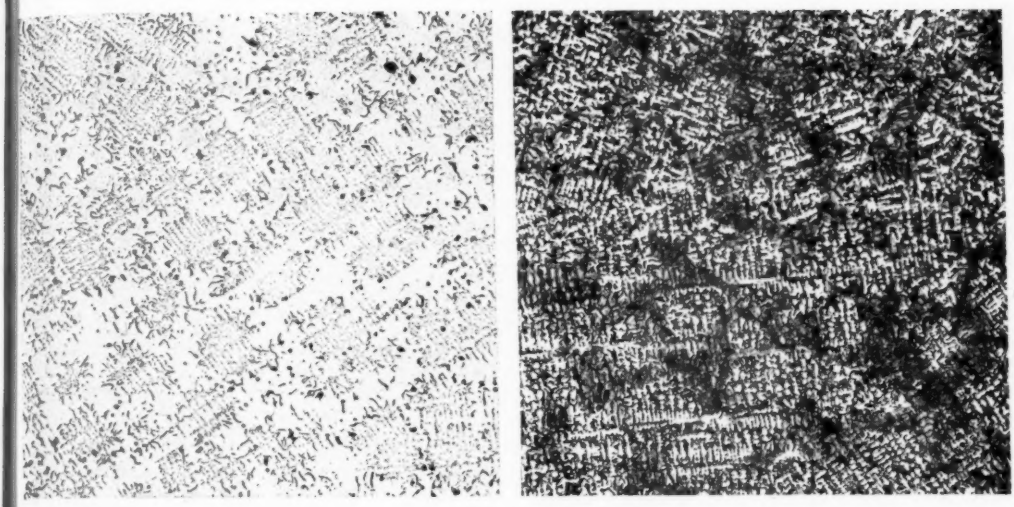


FIG. 12.—*Typical photomicrographs of type-A cast-iron die-pressed gutters; (a) (left) unetched and (b) etched in picral; both* × 100.

Tensile strength and hardness are very satisfactory, and shock resistance is superior to that of sand castings of similar design.

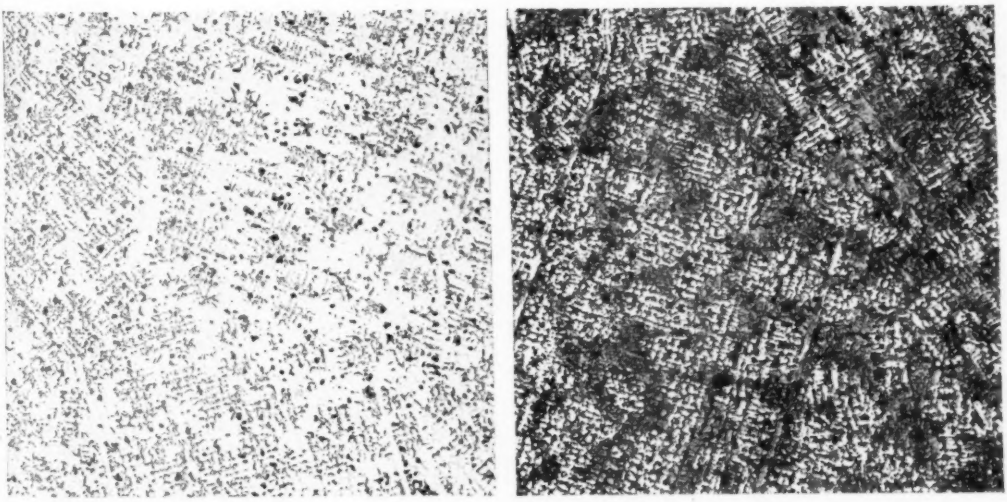
Structural Examination.—Specimens for micro-examination were taken from near the edge, midway between the edge and the bottom, and from the bottom, in both types of gutter, in order to see if any variation in structure occurred. In the case of type "A," the specimens were similar and the structure common to all three is shown in Figs. 12 (*a*) and (*b*). This consists chiefly of clusters of under-cooled graphite, framed by small amounts of very fine, flake graphite in a matrix of pearlite and ferrite and phosphide eutectic in a fine network.

With type "B," however, gradations in the amount of pearlite and flake graphite were found as follow:—

Figs. 13 (*a*) & (*b*).—*Specimen very near edge of gutter.*

Under-cooled graphite, with only traces of

FIG. 13.—*Photomicrographs of type-B gutter, specimen taken very near the edge; (a) (left) unetched and (b) etched; both* × 100.



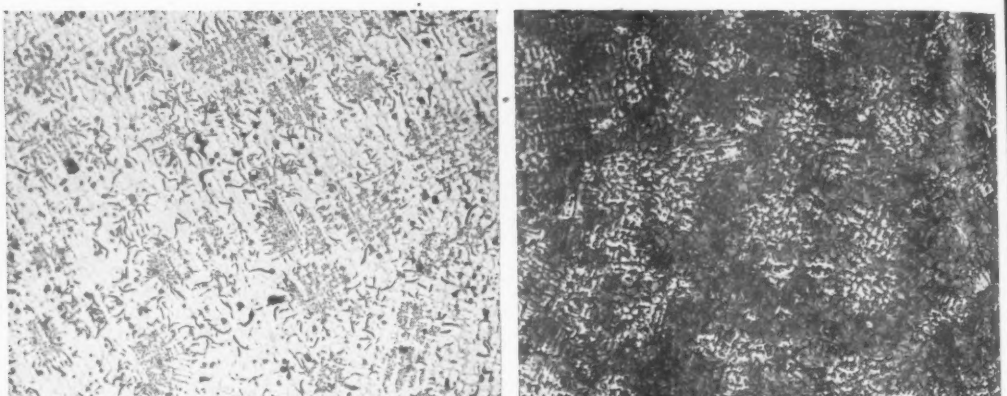


FIG. 14.—*Similar material to that shown in Fig.* 13 *but specimen taken midway from edge and bottom of gutter;* (*a*) (*left*) *unetched and* (*b*) *etched; both* ×100.

flake graphite in a matrix of more ferrite than pearlite.

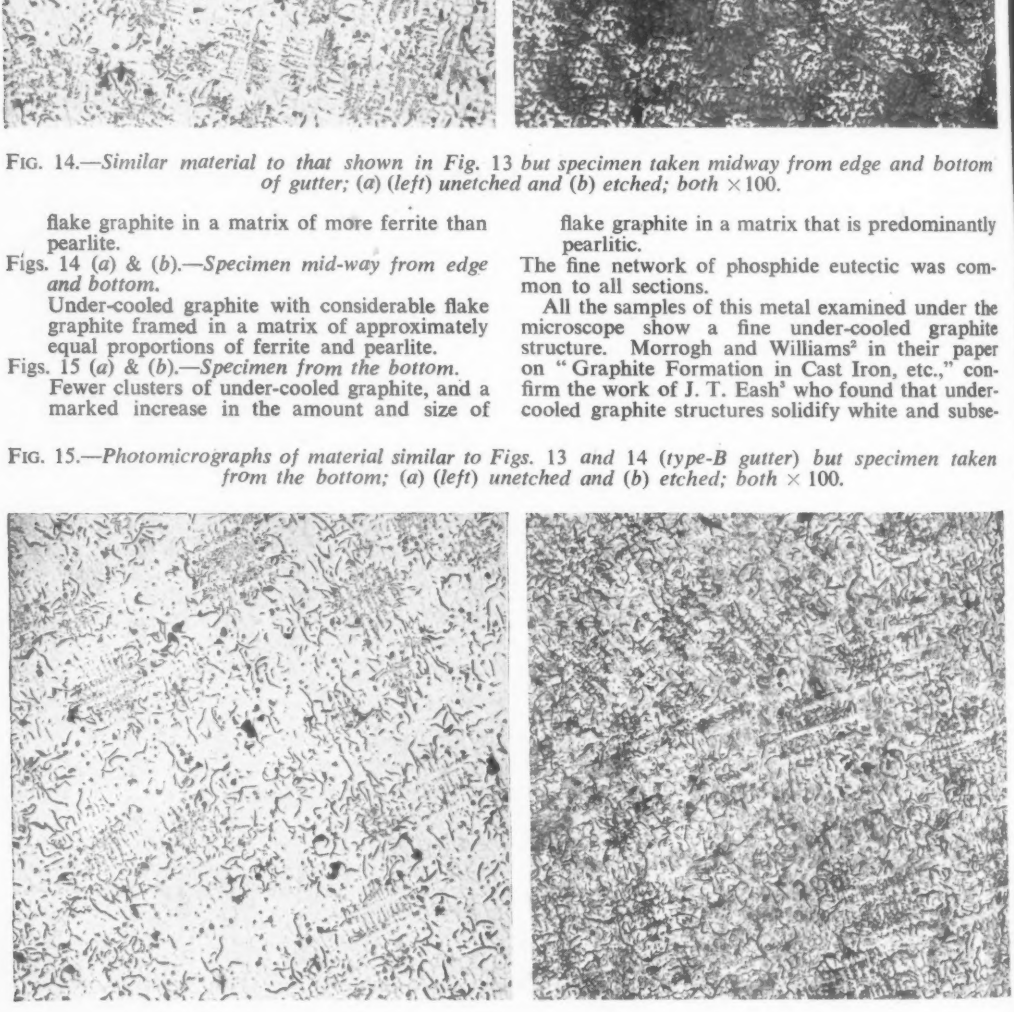
Figs. 14 (*a*) & (*b*).—*Specimen mid-way from edge and bottom.*
Under-cooled graphite with considerable flake graphite framed in a matrix of approximately equal proportions of ferrite and pearlite.

Figs. 15 (*a*) & (*b*).—*Specimen from the bottom.*
Fewer clusters of under-cooled graphite, and a marked increase in the amount and size of flake graphite in a matrix that is predominantly pearlitic.

The fine network of phosphide eutectic was common to all sections.

All the samples of this metal examined under the microscope show a fine under-cooled graphite structure. Morrogh and Williams[2] in their paper on "Graphite Formation in Cast Iron, etc.," confirm the work of J. T. Eash[3] who found that under-cooled graphite structures solidify white and subse-

FIG. 15.—*Photomicrographs of material similar to Figs.* 13 *and* 14 (*type-B gutter*) *but specimen taken from the bottom;* (*a*) (*left*) *unetched and* (*b*) *etched; both* × 100.



quently decompose to give under-cooled graphite after solidification. It would appear reasonable to assume that this is the explanation of the grey casting obtained by the new die-pressing process.

Acknowledgments

The Authors wish to thank the directors of Federated Foundries Limited for the encouragement and assistance given in the development of the process and for their permission to publish this Paper; also Mr. Morrogh and Mr. Sumner of the British Cast Iron Research Association for assistance in the technical aspects.

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[2] H. Morrogh & W. J. Williams.—"Graphite Formation in Cast Iron and in Nickel/Carbon and Cobalt/Carbon Alloys." *Journal* Iron & Steel Institute, March, 1947.
[3] J. T. Eash.—*Trans.* A.F.S., 1941, **49**, 887–906.

Geneva Meeting of I.L.O. Iron and Steel Committee

Human relations in the iron and steel industry and supplementary pensions schemes in the industry are two of the three items on the agenda of the fifth session of the Iron and Steel Committee of the International Labour Organization which opened at Geneva last week. The session is expected to continue until October 23. The agenda also includes consideration of the general report, covering action taken in various countries in the light of conclusions adopted at previous sessions of the committee, steps taken by the International Labour Office to follow up the studies and inquiries proposed by the committee, and recent events and developments which have taken place in the iron and steel industry.

The employers' representatives are Mr. Richard Mather and Col. J. M. Bevan, both of whom are members of the Executive Committee of the British Iron and Steel Federation. Mr. Mather is chairman and managing director of Skinningrove Iron Company, Limited. Col. Bevan is chairman of Briton Ferry Steel Company, Limited, and of other companies. He is also a member of the central council of the Iron and Steel Trades Employers' Association and chairman of the South Wales Siemens Steel Association.

Mr. Mather and Col. Bevan have as advisers Mr. James Ross, director of the Iron and Steel Trades Employers' Association and a member of the council of the British Employers' Confederation, and Mr. A. W. W. Watson, head of the British Iron and Steel Federation's Labour Department, secretary of the central council of the Iron and Steel Trades Employers' Association, and a member of the council of the British Employers' Confederation.

The workers' representatives are Mr. D. H. Davies, assistant general secretary of the Iron and Steel Trades Confederation, and Mr. J. O'Hagan, a member of the T.U.C. General Council and general secretary of the National Union of Blastfurnacemen, Ore Miners, Coke Workers, and Kindred Trades.

Representing the British Government at Geneva are Mr. N. Singleton, assistant secretary, Ministry of Labour and National Service, and Mr. R. S. Swift, assistant secretary, Ministry of Pensions and National Insurance.

Growing Importance of Oil

For the first time, oil last year made a greater contribution to energy requirements than coal in the world as a whole. This was referred to by Mr. Geoffrey Lloyd, Minister of Fuel and Power, when he paid an informal visit recently to the Shell refinery at Stanlow (Cheshire), which produces 4,500,000 tons of petroleum products a year. The oil industry, Mr. Lloyd declared, was unquestionably one of the most dynamic and progressive industries in the modern world. In this country, for many years ahead, the bulk of our energy requirements would undeniably have to be met by coal, but the contribution made by oil had been steadily increasing for several years and it was already equivalent to many million tons of coal a year.

Britain's oil exports are now worth over £80,000,000 a year—well over the value of coal exports—according to Mr. E. F. Choppen, assistant general sales manager of the Esso Petroleum Company, Limited. He said recently in Glasgow that, at a cost of £190,000,000 to the companies concerned, Britain's oil-refining capacity had been raised from 2,500,000 tons in 1948 to nearly 29,000,000 tons in 1954. Britain was thus the third greatest refining nation.

Figures issued by the Petroleum Information Bureau show that the amount of crude oil and petroleum products shipped in international trade far exceeds that of any other commodity. Last year 138,000,000 metric tons of crude oil and 91,000,000 metric tons of refined products were exported by all countries.

At 136,000,000 tons, coal was the next largest item in world trade in 1953, cereals, which totalled 42,000,000 tons, holding third place. The oil and coal figures exclude ships' bunkers. Last year's oil shipments were 13,000,000 tons more than in 1952, but world exports of coal declined by 11,000,000 tons.

Factory Acts Offences

At Leek (Staffs) Magistrates' Court recently, fines totalling £25, with £1 2s. costs, were imposed on the Moorlands Engineering Company, Limited, Leek, for breaches of the Factory Acts.

Mr. Edmund Waller said that Mr. G. Linden, H.M. Inspector of Factories, visited the firm's premises. It was alleged that the dressing shop was "extremely filthy," with refuse and dust 2- to 6-in. thick on the floor. The dirt had been so compressed that a crowbar was needed to get to the floor. The second charge related to the failure to whitewash or colour-wash walls, the third to the failure to have a 16-year-old apprentice medically examined, and the fourth to the failure to have fenced the shaft of a travelling crane, revolving from zero up to 150 r.p.m.

Mr. G. L. M. Lichfield, defending, said that the firm had experienced a shortage of staff. The deposit on the floor was sand, not dust, and the case relating to the medical examination was an "administrative slip-up." The shaft referred to was not one to which any of the men in the factory had access in the course of their normal duties, and the driver of the crane did all his own maintenance. There was no question of anyone else being endangered. All the matters had since been dealt with. The firm was fined £5 in the first two cases, £5 in the case relating to medical examination, and £10 in the case relating to the machinery.

DAVID BROWN CORPORATION LIMITED—Mr. Allan Avison and Mr. David Brown, junior, have been appointed additional directors.

H.

Institute of Vitreous Enamellers

Annual General Meeting and Conference in Manchester.

On Thursday, Friday and Saturday, October 7 to 9, the annual general meeting and conference of the Institute of Vitreous Enamellers was held in Manchester, with headquarters at the Midland Hotel. About 100 members attended the technical sessions and, with the ladies and guests, the numbers swelled to close on 200 for the annual banquet. It was perhaps a little unfortunate that the weather lived up to the Mancunian reputation on the Friday for the works visits, because in the murky haze one of the coaches could not seem to find the works even when it was on the doorstep. However, not even Friday's weather could cast a blight on the proceedings, which, both technical and social, were commendably well organized and meticulously carried through.

Chairman's Report

The proceedings began with the annual general meeting, held in the Alexandra Room of the hotel on Thursday morning, with Dr. H. Hartley presiding, and the Chairman of Council, Mr. A. Biddulph, officiating. After the formal approval of the minutes, the Chairman gave his report on the activities of the past year. In the course of his report he said that, arising from the financial position, it had been decided to try and augment the membership rather than the amount of the individual subscription. A revision of the Articles of Association had been put in hand to bring them into line with current requirements. As to the technical sub-committees, two of these—on organic suspension-agents and on scumming—had presented reports during the year at the Eastbourne Spring conference, and others were due at the present conference. A recommendation had been made, with the co-operation of Dr. H. W. Webb, O.B.E., past-president, for further aspects of one technical matter to be the subject of research in an educational institution. The "summer school" (at Ashorne Hill) this year had been better attended than in the previous year and the function would be repeated next year. The raw-materials sub-committee had been instrumental during the year in facilitating importation of lithium carbonate which had been in short supply; similarly, a current shortage of sodium silicofluoride was being tackled.

Announcing the 1955 annual conference to be held in Leamington, the Chairman made clear its international character and registered the fact that it was in that year the Institute would attain its majority—an event to be fittingly celebrated. Membership during the year had slightly increased, but there were still many prospective firms and individuals to whom it was hoped to demonstrate the services the Institute could offer through membership. Mr. Biddulph then referred briefly to the valuable work of the local sections; the awards open to competition among members, and closed on a note of appreciation to the secretaries.

Treasurer's Report

The next item on the agenda was the treasurer's report and adoption of the statement of accounts and balance sheet which had been circulated. These showed a quite healthy position, with a slight excess of income over expenditure, after transferring £115 to the research account and development fund (now standing at £1,225). Their formal adoption was moved by the honorary treasurer, Mr. W. S. Grainger, and endorsed by the meeting.

Election of Officers

Next came the formal election as president of Sir George Briggs, managing director, Simplex Electric Company, Limited, who had been serving as vice-president. Sir George was unavoidably absent from the meeting owing to illness and coupled with the unanimous vote approving his elevation to the presidency, was a wish for his rapid return to full health. It was announced that the presidential address which Sir George had prepared would be read by Mr. J. W. Gardom, a past-president of the Institute.

The result of the ballot for the election of three members to fill vacancies on the Council was next announced by the scrutineers (Mr. A. G. Jones and Mr. A. R. Parkes), through the chairman. Mr. J. Hooper, Mr. T. J. McArthur and Mr. W. Thomas were returned to the Council as a result of the ballot.

Awards

The Chairman then announced the winners of the Institute Awards for the session just closed. The Whittle Medal and prize had been awarded by the Council to Mr. K. Maskell, of Richmond's Gas Stove Company, Limited (one of the Radiation group), for his Paper "Towards Thinner Groundcoats." Mr. E. R. Evans (British Cast Iron Research Association) was given the Grainger Medal for the best Paper before the sections in the period under review. His contribution was on blistering of cast-iron enamels, presented to the Midland section of the Institute. The occasion was then made use of for the actual formal presentation of the same award to Mr. H. Laithwaite, though it was for a Paper delivered the previous year.

"Why Vitreous Enamel?"

The above was the title of the presidential address and in it Sir George had recorded an aggressive viewpoint, namely, that vitreous enamelling had been chosen in the past and would continue to be used in the future solely because it was best for the job. "Best" included cheapest, having regard to technical excellence, and suitability for giving adequate "life" to a component as compared with so-called substitute finishes. He quoted the current annual production of 400,000 electric

cookers in this country as likely to expand to 1,000,000—all requiring vitreous enamel. Reviewing current practice, he traced the impact of design and processing scrap, keeping ultimate component cost very much in mind. In his view, the survival of the whole vitreous-enamelling industry depends on research and dissemination of results and he made a plea for more research, both practical and academic, to be carried out and discussed by men who were closely in touch with the actual job.

Technical Session

The presidential address concluded the annual general meeting and technical sessions commenced after a short break for refreshment. The first Paper presented was by Mr. W. H. F. Tickle on "Methods of Measuring Enamel Adhesion." After briefly surveying the history of adhesion testing, Mr. Tickle gave a synopsis of his own experiments and showed several slides of results. The test method which appeared to give most reproducible results was based on a bend test of an enamelled coupon up to the point of flaking-off of the enamel, coupled with an electrical e.m.f. measurement by potentiometer of the cell formed with the coupon and acidified water. After a short discussion, the proceedings adjourned for luncheon.

Recommencing the session, with Dr. H. Hartley in the chair, members heard a composite Paper "Direct Application of Finish-coat Enamels to Steel." The first part, "general considerations," was presented by Mr. A. W. Murdoch, and the second, "shop practice," by Mr. B. Zick, both on the staff of Ferro Enamels, Limited. The procedures reported were largely procured as a result of a visit to the United States and samples of ware had been brought back for showing to members. A price-comparison table was given for a single component, first, as treated in normal fashion (with a ground-coat), and secondly, in titanium steel with only single-coat enamel. A substantial saving was shown, though Mr. Zick confessed that only 40 per cent. of the items enamelled passed inspection with the single coat, the others requiring two or three coats. The considerable discussion which followed hinged largely upon the economics of the process as related to conditions of steel supply and processing conditions in this country.

Competitive Finishes

Technical session "B" was held on the Friday morning, with Mr. Biddulph presiding. This took the form of a symposium on the "Challenge from Competitive Finishes"; Mr. J. Hooper (Editor, *Sheet Metal Industries*) introduced the subject and afterwards summed up; Mr. E. W. B. Dunning (North Thames Gas Board) gave the consumer viewpoint; Mr. G. Murray (Pressed Steel Company, Limited), outlined practical applications of competitive finishes, and Mr. H. Silman (research manager, Ford Motor Company, Limited) dealt with scientific and technical aspects. As had been expected, this exposition evoked a lively discussion. While no concession was made that any of the competitive finishes described (and exhibited) was a proper substitute for vitreous enamel, it was clear that members well appreciated the implications of possible competition. Most urgently arising was the obvious need for better co-operative propaganda extolling the merits and virtues of vitreous enamel. It was generally agreed there was little room for complacency, for although other "Patented" finishes were not real substitutes, some were so well supported by national advertising campaigns that they soon became household names.

At the final technical session on Saturday morning, the chairman, Mr. J. W. Gardom, first briefly reviewed the work of the technical sub-committees and work in hand, and then opened the meeting for general discussion. This mainly concerned ways and means of implementing publicity for vitreous enamelling—arising from the previous day's session—and a critical examination of the conference programme and order of events. It was announced that although in the future no Spring conference will be organized, there is to be a works visit to the Steel Company of Wales early next year, organized for members on a national basis.

"Question Box"

Finally, to conclude the technical sessions, the "question box" feature was held, one question having been posed for general discussion among members. This requested information on the merits and disadvantages of dry-process *vis-à-vis* wet-process enamelling for stove-grate and cooker castings, and asked if any recent comparative researches had been carried out on economics, quality of finish, and service life of components treated by the two methods. It was clear that British enamellers were firmly wedded to wet-process treatment of such components, though a member confessed that up-to-date technical comparisons might show a number of factors favourable to dry processing. Technically speaking, it was doubted if dry-process enamelled ware produced on the Continent had the same high acid-resistance, gloss, durability or uniformity now to be associated with British enamelling.

Social Events

The premier social event of the conference was the annual banquet and dance, held on the Wednesday evening in the Midland Hotel, Manchester, presided over by Dr. H. Hartley (past-president) deputizing for Sir George Briggs. After the "loyal" toast, that of the "Institute and the Industry" was proposed by Professor F. C. Thompson, D.MET., M.SC., and Mr. Biddulph responded. The health of "The Guests" (in which category "The Ladies" was combined) was proposed by Mr. J. W. Gardom in a short but amusing manner, and Mr. W. N. Duffy, M.S.I.A., replied. The evening concluded with dancing until 1.0 a.m. to Orlando and his Orchestra.

The following evening was devoted to dinner and entertainment of less formal character, but was nonetheless enjoyable. On this occasion the tables were made up impromptu and light relief was provided by a comedian, pianist, and soprano.

Institute of Vitreous Enamellers

Special events organized for the ladies during the run of the conference included a knitting demonstration at Kendal Milne & Company.

Works Visits

As is usual the works visits were one of the highlights of the conference, and this year both were well attended. About 50 members went to Blake Vitreous Enamelling, Limited (at Accrington), and about 30 to the works of Ferranti, Limited, at Hollinwood. At each establishment elaborate arrangements had been made for the conduct, edification and refreshment of the visiting parties and, if the Hollinwood works boasted no vitreous enamelling, there was a host of other interesting items. The foundry, transformer shops, machine-shops and light-assembly sections were traversed at this works and all who participated were well pleased with the interest afforded. Blake's, of course, was an enameller's ideal for a works visit, and it is doubtful if any member who went there talked anything but "shop" during the visit or for several hours afterwards.

Taken altogether, the conference was a very satisfactory expression of co-operative thought and action within the enamelling industry and the organizers can take credit for the clockwork precision with which the whole programme was carried through. There is no doubt that this annual gathering of technical, managerial, research and sales personnel does much to secure appreciation of each other's point of view and results in a valuable impetus being given to progress within the industry.

British Industries Fair, 1955

Substantial reductions in exhibiting costs for the British Industries Fair, 1955, are announced for the London section. For example, a stand 384 sq. ft. that this year cost £112 4s. to build will next year cost £86 4s., following the introduction of a new basic charge for stand construction of 4s. 6d. per sq. ft., which will mean big savings for most exhibitors. The larger stands will cost about the same as last year, but cuts are being made in the charges for electrical fittings and installations to all exhibitors. The cost of space remains at 6s. 6d. per sq. ft. as in previous years.

While the Fair (to be held from May 2 to 13) is aimed at increasing export trade, additional emphasis will next year be placed on products for the home market. Greater efforts are also being made to attract and welcome the general public, who will be admitted every afternoon from 2 p.m. and on one evening each week when the hours of opening are being extended until 9 p.m.

Latest Foundry Statistics

The output of copper-base castings, according to the British Bureau of Non-Ferrous Metal Statistics was 4,690 tons during August, 1954, and 40,222 for the first eight months of this year, as against 31,156 tons for the corresponding period of 1953.

Baghdad Trade Fair, Oct. 25 to Nov. 8

On October 25 King Feisal II of Iraq will open an all-British trade fair at Baghdad which will be on a scale never before attempted in the Middle East by any nation. The fair, which will remain open until November 8, occupies a site of 100,000 sq. metres. There will be over 400 exhibitors, with a total of 15,000 sq. metres of stand space. The object of the fair, which is being run by British Overseas Fair Limited, a subsidiary company of the Federation of British Industries, is to show the countries of the Middle East, including Turkey, the contribution which Britain can make to their plans for development. For this reason, the emphasis is mainly on capital equipment, but there will also be a representative display of consumer goods of all kinds.

Special attractions will include an ice-rink, with professional skaters from London, a demonstration of irrigation, television, and an open-air cinema showing British films. Entering the fair, the visitor will first see the British Government pavilion, which contains an information bureau for trade buyers, and opposite it the Iraqi Government pavilion with a display of models illustrating the country's plans for capital development.

Beyond the Government Pavilions, the visitor will see the quarter-mile long main avenue with the floodlit fountain at the end and, to the right and left, the stands of the exhibitors. On the right, the sections alloted to the motor industry, cycles and motor cycles, engineering products, and consumer goods: on the left, contractors' plant and agricultural machinery, the demonstration area (where earth-moving equipment will be seen in operation), and sections set aside for general and sales services, and agencies. Among the mechanical and electrical-engineering equipment in the engineering section will be electric transformers, motors, generators and control gear; refrigeration and air-conditioning equipment, including domestic refrigerators; textile machinery; foundry equipment; pumps and pumping equipment for industrial and domestic uses, and compressed-air tools.

New Catalogues

Die-castings. A folder received from Slough Metals Limited, Oxford Avenue, Trading Estate, Slough, illustrates a wide variety of castings they manufacture, tabulates the alloys currently handled and includes a map.

Extension Bench. From the Shandon Scientific Company, 6, Cromwell Place, London, S.W.7, a leaflet has been received which illustrates and describes an attachment—known as the Rolla-Bench—which adds five sq. ft. of extra working space to a bench. It requires a guide rail to be fastened to an existing bench and along this slides a table carrying two tyred wheels, and a hinged extension piece. This catalogue is available on writing to Cromwell Place.

Heating Stoves. Three leaflets dealing respectively with the New Panda; New Rayburn and the Polkadot stoves have been received from Allied Ironfounders Limited, 28, Brook Street, London, W.1. They are obviously meant for distribution by the wholesalers, retailers and for use at exhibitions, thus entering into a class a little remote from those usually reviewed. It can be presumed such catalogues must be colourful to attract attention; they must give data, selling points and simple technical specifications. In all these aspects, these leaflets are particularly satisfying, and are a great improvement on the shoddy type of drab publicity matter of 20 years ago.

Theory, Economics and Practical Application of Exothermic Materials*

Discussion of the Paper by D. V. Atterton, M.A., Ph.D., and R. C. Edmonds

When this Paper was presented at the annual conference of the Institute of British Foundrymen in Glasgow, the considerable discussion indicated the intense interest of both ferrous and non-ferrous foundrymen in the still quite novel application of exothermic and insulating materials with the aim of producing properly fed castings. The opening remarks, reviewing the complementary researches of the British Non-Ferrous Metals Research Association, made interesting comparisons between inert insulation and exothermic assistance. It was stressed, however, that economic aspects could only be assessed as related to individual applications and even then the methods would seem to offer little advantage for very small castings. Other points concerned actual temperature increments; the possibility of composite insulating/exothermic sleeves; alternative moulding materials having different chilling power and alternative methods of achieving good feeding. A final contribution referred to the possibility of furnishing Thermit feeder-head metal to match the composition of the casting.

After the presentation of the Paper, THE CHAIRMAN (Mr. E. Longden), opening the meeting for discussion, emphasized the great importance of the subject, about which much had been said and done and experimented on, particularly during the past five or six years.

MR. R. W. RUDDLE (British Non-Ferrous Metals Research Association) said the Authors were to be congratulated on a most useful and helpful Paper which he was sure would be of great assistance to all foundrymen. The B.N.F.M.R.A. had also been interested in improved methods of feeding castings and had carried out a good deal of experimental work on both exothermic and porous-plaster insulating sleeves in its laboratories and in the works of member firms. The results of some of their earlier work on that subject were published in a paper by Skinner and himself[1] given to the A.B.B.F. Productivity Conference held at Harrogate in 1952.

It would perhaps be of interest in connection with the present Paper to describe some of the more recent results which Mr. Skinner had obtained.[2] The Association's work was, of course, confined to non-ferrous alloys, and thus was complementary to that of Atterton and Edmonds, who were principally concerned with ferrous castings.

Complementary Research

Dealing with the laboratory research, he said that in the work discussed in the earlier paper it was shown that the size of feeders attached to aluminium-bronze and high-tensile brass castings could be greatly reduced by the employment of exothermic or plaster sleeves, and laboratory tests were described of the application of those techniques to plate castings which were considered representative of castings of relatively thin section. Further laboratory experiments had since been made on the application of those techniques to cylindrical castings 4-in. dia. by 6-in. high—a type chosen as being representative of "chunky" castings.

The experimental set-up was as illustrated in Fig. A, in which it could be seen that thermocouples were used to measure the freezing times of the casting and of the feeder. The casting was surrounded by a sleeve of plaster or exothermic material.

All the castings in that work were made in (90/10) aluminium-bronze. The minimum sizes of normal sand-moulded feeders, and of feeders sleeved in plaster or exothermic material, which would feed the castings were given in Table Y for both open-topped feeders and for feeders whose tops were closed, *i.e.*, blind feeders. The table also showed the efficiency of the different feeders relative to the open sand-moulded feeder, this efficiency

* Paper printed in the JOURNAL September 30, and October 7, 1954.

TABLE Y.—*Minimum Feeder Size for Cylinder Castings 4-in. dia. (Insulating Sleeves ½-in. thick.)*

	Sand.		Plaster.		Exothermic.	
	Open.	Blind.	Open.	Blind.	Open.	Blind.
Minimum Feeder Size	4½-in.dia. by 6 in.*	Just larger than 4-in. dia. by 6 in.	2¼-in. dia. by 3¼ in.	2½-in. dia. by 3 in.*	2-in. dia. by 3 in.	Just larger than 2-in. dia. by 3 in.
Feeder Volume (cub. in.) ..	95.5	> 75.7	18.4	14.6	9.6	> 9.6
Feeder (V/A)² (sq. in.)	0.70	> 0.56	0.22	0.20	0.14	> 0.14
Efficiency related to an open-sand-moulded feeder ..	1.0	< 1.3	5.2	6.5	10.0	< 10.0

Casting (V/A)² = 0.53 sq. in. * Feeder of sub-standard size.

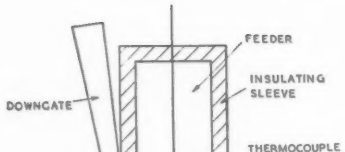


FIG. A.—*Arrangement of cylinder castings, showing: feeder in an insulating sleeve, cylinder, tapered downgate and thermocouple positions.*

being defined as the volume of the minimum size of open sand-moulded feeder divided by the volume of the minimum size of sleeved feeder. The figures showed that the use of feeders sleeved in both porous plaster and in exothermic materials permitted substantial reduction in the feeder volume, the efficiencies of those feeders being from 5 to 10 times greater than that of conventional feeders, or even more. Exothermic-sleeved feeders were found to be rather more efficient than plaster-sleeved feeders, and blind feeders were generally more efficient than open-topped feeders.

In that work it was found that the efficiency of plaster-sleeved feeders did not greatly depend on the sleeve thickness, provided that that was not less than about ½ in. It was thought, however, that the efficiency of an exothermic sleeve would be more affected by the sleeve thickness, since more heat would be liberated during the combustion period of thicker sleeves. Further tests showed that that was in fact the case, the freezing time of feeders 2-in. dia. made in exothermic sleeves ¼ in. thick being about 40 per cent. greater than that of similar feeders made in sleeves ½-in. thick.

With non-ferrous alloys, the use of exothermic sleeves entailed some disadvantage in that there was a tendency for gas evolved from the sleeves to gas the metal in the feeders—in some cases metal thus gassed was drawn into the casting itself. It was found that the gassing tendency markedly increased with the thickness of the sleeve, and that must clearly be taken into account when deciding the sleeve thickness. If the sleeve thickness were correctly chosen, the danger of the gas penetrating into the casting was probably not very great.

Washburn Cores

Discussing some trials of Washburn cores, Mr. Ruddle said that clearly the improved feeding techniques greatly lessened the work involved in severing feeders from castings, on account of the much smaller area of contact. However, it appeared that fettling could be even further facilitated by incorporating Washburn cores with plaster sleeves, and some experiments were made to test that suggestion. In trials with 2¼-in. dia. plaster-sleeved feeders it was found that, without seriously impeding feeding, the neck between the feeder and casting could be reduced to ¾-in. dia. by means of a Washburn core ¼-in. thick, also made in plaster. The core thickness was found to be critical and should not exceed the dimension quoted.

The removal of the minimum effective size of sand-moulded feeder (4½-in. dia.) involved cutting through 12½ sq. in. of metal, but the use of a plaster-sleeved feeder reduced that area to 4.9 sq. in., and a feeder sleeved in exothermic material reduced it to an even smaller figure—about 3½ sq. in. The combined use of a plaster sleeve and a Washburn core with a hole ¾-in. dia. further reduced the area to be cut through to 0.4 sq. in. The savings in fettling costs were obvious, but whether the use of those cores would be economic depended upon several factors, including:—(*a*) Size of feeder; (*b*) alloy; and (*c*) cutting facilities available.

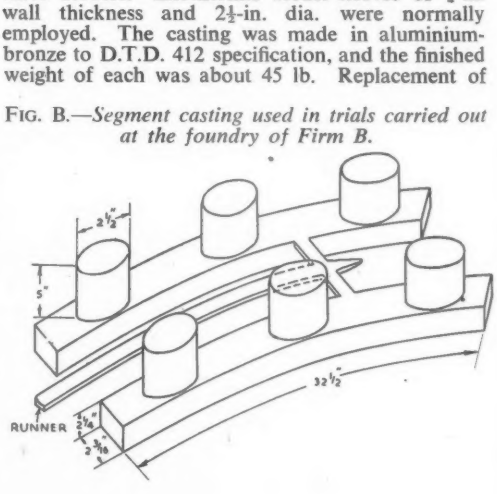
It seemed likely that Washburn cores would be most advantageous for the large feeders of heavy castings in hard or tough alloys, such as aluminium-bronze or high-tensile brass. Washburn cores should be particularly advantageous in the smaller foundry which does not possess a large cutting-off wheel, with which heavy feeders could be removed.

Works Trials

Coming to works trials, Mr. Ruddle said that the B.N.F.M.R.A., with the co-operation of its members, had carried out several field trials of improved feeding techniques. One such trial, concerning the feeding of an axle-box casting, had been described, he said, in a paper to which he had already referred[1], and he then described some subsequent trials. One of those trials was made on the segment casting illustrated in Fig. B.

The castings were about 2¼-in. square in. section, and were cast in pairs, each casting being fed by three feeders. Exothermic feeder-sleeves of ¾-in. wall thickness and 2½-in. dia. were normally employed. The casting was made in aluminium-bronze to D.T.D. 412 specification, and the finished weight of each was about 45 lb. Replacement of

FIG. B.—*Segment casting used in trials carried out at the foundry of Firm B.*



the exothermic sleeves by plaster sleeves showed that that size of plaster-sleeved feeder (2½-in. dia.) was inadequate to feed the casting completely, the pipe in the feeder penetrating into the casting itself. In subsequent experiments, plaster sleeves of the same size as the exothermic sleeves were again employed and were used in conjunction with loose plugs of exothermic material which floated down with the shrinking metal surface. That technique reduced the length of the pipe and the castings were sound; no gas was absorbed from the exothermic plugs.

The results obtained were summarized in Table Z which showed the marked increase in casting yield resulting from the use of those improved techniques as compared with normal sand-moulded feeders. The weight of the feeders was reduced in the extreme cases from 28 lb. with the normal sand-moulded feeders to 8 lb. with exothermic sleeves and plugs.

TABLE Z.—*Details of Feeders used with Segment Casting—Experiments made at the Foundry of Firm B.*

Feeding Method.	Feeder Weight (lb.).	Reduction in Feeder Weight (per cent.).	Casting Yield (per cent.).
Normal sand-moulded feeders	28	0	58.8
Exothermic sleeves (2½ in. i.d.)	15½	45	70.4
Plaster sleeves (2½ in. i.d.) plus exothermic plug ..	13½	52	72.6
Exothermic sleeves (2 in. i.d.)	8	72	79.7

It was thought that the plaster sleeves alone were less efficient than exothermic sleeves of the same diameter and did not feed the casting properly because the feeders in that particular casting were remote from the ingates and were filled with relatively cold metal. In those circumstances, the heat generated by the exothermic material should result in a marked improvement in feeding efficiency. Although most of the work was carried out using 2½-in. dia. feeders, that size was not in fact the minimum capable of giving satisfactory results when exothermic sleeves were used. As the last results in Table Z showed, sleeves of exothermic material 2-in. dia. were quite satisfactory.

Further trials were conducted with a ring casting 4-ft. dia. by 2½-in. thick by 4⅝-in. deep, weighing 450 lb. That casting was run through ingates at diametrically opposite sides, from a common sprue, and there were eight feeder heads spaced evenly along the top surface of the ring. In the established practice, feeders of 2½-in. dia. were enclosed in exothermic sleeves of ¼-in. wall thickness and 5-in. tall. Trials showed that the exothermic sleeves could be replaced by plaster sleeves with exothermic plugs without detriment to the casting. In those trials the weight of the feeders was about 35 lb., and the casting yield was around 90 per cent.

General Conclusions

Giving conclusions from this work, Mr. Ruddle said it was difficult to generalize about the economic aspects of improved feeding methods. Clearly the economics of the matter depended upon the balance between the cost of the sleeve and the saving resulting from the increased yield and reduced fettling costs which accrued, and those factors would obviously vary from casting to casting. Plaster sleeves were considerably cheapear than exothermic sleeves (about one-third of the cost), and it seemed, therefore, that their use should be favoured for castings in which hot metal entered the feeder and in other circumstances where the difference in efficiency between plaster- and exothermic-sleeved feeders was not large. On the other hand, in the case of bottom-gated castings, exothermic sleeves appeared to have a considerable technical advantage which might well justify their higher cost. Often, the combination of plaster sleeves and exothermic plugs might be a useful compromise.

The freezing time of the casting might also be important, Mr. Ruddle added. Exothermic sleeves generated their heat within a few minutes after casting and thereafter abstracted heat from the feeder at much the same rate as a sand mould, possibly a little slower. The insulating effect of a plaster sleeve, on the other hand, lasted indefinitely, and the difference in the relative efficiencies of exothermic- and plaster-sleeved feeders might therefore be less in the case of large castings which took some hours to freeze. It was possible that with very large castings, the plaster sleeve was the more efficient of the two.

It seemed most improbable that such methods of feeding would ever be of great value with small castings, for the costs of applying the method and of the sleeve would be out of all proportion to the saving produced. Fettling-cost savings and metal savings, however, increased rapidly with the size of the casting, and the cost of applying the method, per lb., decreased. Therefore, those methods should have a wide field of usefulness with castings of medium and large size.

Importance of Residual Heat

DR. ATTERTON thanked Mr. Ruddle for his most interesting and extensive remarks, which were certainly very complementary to the Paper and added considerable value to it. Referring to Table II, which showed the various yields that had been obtained during practical trials with conventional exothermic and plaster plus exothermic-plug feeders, Dr. Atterton said that, although the increases in yield were most encouraging, he felt that even better yields could have been obtained. Thus, with the exothermic sleeve 2½-in. dia. which resulted in an increase in yield from 50 to 70 per cent., it might have been preferable to reduce the height of the sleeve rather than cut down the sleeve diameter. However, the relative merits of such approaches could only be elucidated in practical trials in the foundry; Mr. Ruddle's results showed clearly the important factor that exothermic and insulating methods did result in considerable increases in yield, along with a greater guarantee of a sound casting.

With regard to his reference to the results obtained with plaster and with exothermic sleeves on

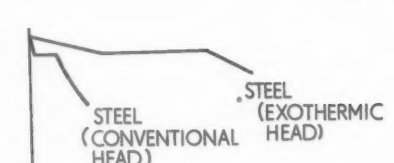


FIG. C.—*Temperature/time curves in conventional and exothermic heats (schematic).*

large castings, Dr. Atterton suggested that there were insufficient data with plaster sleeves to discuss the relative merits in this case. However, the academic point was raised that after the exothermic reaction in the sleeve was complete, the rate of heat abstraction was similar to that of moulding sand. This was not supported either by practical tests; in addition, the figures in Table II showed that the thermal conductivity of a typically-bonded moulding sand was about twice that of a burnt-out exothermic sleeve. Even of greater importance was the temperature of the material surrounding the feeder head; the temperature attained in an exothermic sleeve was somewhere in the region of 1,700 deg. C. and consequently, although this would cool as heat was abstracted both by the feeder head and by the backing sand, the heat would be in contact with a *hot* incubator. The use of insulating tiles in ingot practice presented a useful analogy—there was a considerable increase in ingot yield as the temperature of the low-thermal-conductivity tile was increased. This temperature dependence appeared to be of greater importance than slight reductions in the thermal conductivity of the tile and this was supported by the very high yields on ingots obtained with tiles fabricated from exothermic material.

He agreed that it was difficult to generalize on the minimum size of casting for which it would be economical to use exothermic or plaster sleeves; this depended greatly on the metal being cast, the type of casting, etc. Certain cases had been investigated where it was virtually impossible to obtain a sound casting with conventional heads; also, as in Table V of the Paper, there were small steel castings of about one hundredweight where a substantial saving consequent upon the use of exothermic sleeves was made. The monetary savings on castings of such weight made of more valuable metals would naturally be greater.

Metal Temperature Increment

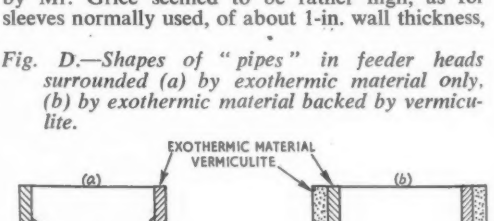
MR. J. GRICE wrote that in the discussion of a paper presented by Mr. Skinner and Mr. Ruddle to the Brass Founders' Productivity Conference at Harrogate in 1952, Dr. Atterton had made the following statement, "the purpose of exothermic materials was twofold (*a*) to superheat the feed metal and (*b*) to insulate this superheated metal and reduce its rate of cooling relative to the casting bulk." The inference from both parts of this statement was that the exothermic reaction increased the temperature of the metal in the feeder. Further, in a paper given in Germany by Dr. E. Lazendorfer in 1951 it was categorically stated that "the shape (a sleeve) is ignited, the resulting exothermic reaction produces a temperature of up to 2,000 deg. C., most of this heat is transmitted to the metal, and an actual increase in metal temperature results."

However, in Fig. 3 of the current Paper it was shown that there was a gradual reduction in temperature of metal in the feeder, although it must be admitted the pouring temperature was not given. From experience, if the exothermic material can increase the temperature of metal, this increase would not take place until one to two minutes after pouring, as there would be a slight delay extending over this period of time between the metal coming into contact with the sleeve and the actual firing off. If the test shown by Dr. Atterton were correct, it would appear that exothermic materials are virtually little more than insulators. Furthermore, would Dr. Atterton agree that the experiment shown in Fig. 3 is so small that the validity of the results might be questioned.

DR. ATTERTON said the question as to whether there was any superheating of the feeder head depended very much on the metal being cast and on the ratio of feeder head to casting volume. In an experiment such as that illustrated in Fig. 3 but using a light alloy, there would be a very substantial temperature rise. However, with steel, where there would be a very high rate of heat loss with conventional heads, the influence of the exothermic sleeve was to slow down the rate of cooling as indicated in Fig. C.

Measurement of the temperatures attained in exothermic materials was a most difficult piece of experimental procedure; except for sleeves of large wall thickness, the figure of 2,000 deg. C. quoted by Mr. Grice seemed to be rather high, as for sleeves normally used, of about 1-in. wall thickness,

Fig. D.—Shapes of "pipes" in feeder heads surrounded (a) by exothermic material only, (b) by exothermic material backed by vermiculite.



the temperature in the centre was approximately 1,700 to 1,800 deg. C.

Composite Sleeves

MR. D. V. PARANJPE said it had been mentioned that the heat-insulating property of spent exothermic material decreased after a time—that is, after the temperature had dropped—to a value lower than the plaster. He asked whether experiments had been made in which the exothermic sleeve was surrounded by a plaster sleeve, in order to take best advantage of both materials, *viz.*: the heat-generating property of the exothermic compound and the heat-insulating property of plaster.

Dr. Atterton replied that he did not know of experiments where exothermic sleeves had been surrounded by plaster although tests had been made with other high-temperature insulators. He felt that the suggestion was most interesting; heat was certainly lost by conduction into the surrounding backing sand and anything that would reduce this heat loss, should improve efficiency.

However, there was a specific objection to the use of plaster in this connection as there was to its use on high-temperature metals. Above about 1,200 deg. C., plaster was decomposed and would result in sleeve breakdown along with a liberation of sulphur dioxide.

MR. J. E. GOTHERIDGE mentioned an experiment in the making of a steel casting with an exothermic sleeve backed by an insulating material, and said that a certain amount of success had been achieved. A steel casting, weighing 5 tons, had been produced with an exothermic sleeve, 18-in. high, 19-in. o.d. and 16-in. i.d. A sound casting was produced, but the pipe in the head had extended almost to the casting face. Therefore, an identical casting was produced with the same size of exothermic sleeve but backed with a 2-in. layer of vermiculite. The sectioned head showed that the walls of the pipe were not as steep as with the un-backed exothermic sleeve—a result which meant there was a large amount of sound metal at the base of the head. (See Fig. D.) This suggested that the efficiency of an exothermic sleeve could in fact be increased by a backing of vermiculite or some such insulating material.

Practical Politics

MR. A. LOGAN said that in considering matters such as a plaster backing to an exothermic sleeve practical possibilities have to be kept in mind. The suggestion by Mr. Gotheridge was perhaps more practical than some that had been made and might have possibilities, but a vermiculite outer sleeve with an exothermic inner sleeve might possibly suffer by fusion due to the high temperature reached by the exothermic material. He regarded the Paper as being very useful, because it served to focus attention on the use of exothermic materials in the foundry, a matter which was receiving and should receive more attention, as it became of ever widening application.

Primarily the necessity for feeding any casting arose from the fact that during the process of setting, a reduction of volume took place, due to two causes. The first, which was the lesser, was the liquid shrinkage resulting from the temperature drop between the pouring temperature and the freezing point. The second and larger effect, was the contraction in volume which occurred during the change from the liquid to the solid state.

The Authors gave a table of the overall percentage reduction in volume from average pouring temperatures to the solid state, and it would be seen that the range for the alloys usually cast was from 4 to 8 per cent. Even 8 per cent. by volume, however, was not an excessive amount, and it was difficult to tie up that quantity with the size of feeding heads which normally had to be used in the foundry; it was obvious that there was a big discrepancy between the theoretical amount required and the actual amount which it was necessary to use in order to produce sound castings—the actual amount being often many times the theoretical amount. The Authors had given the various factors which rendered the use of such large heads necessary, and the short answer was that a large mass of molten metal was required to maintain in a liquid state the 4, 5, 6 or 8 per cent. which was necessary for feeding, and also to maintain an open channel between the feeder head and the casting, so that the feed metal had fluid access to the solidifying casting whilst the casting required it.

The whole case for the desirability of using exothermic feeding aids rested upon the factor that the casting must solidify before the feeding head, and that the feeding head need then only contain a little more than the theoretical amount of sufficiently-fluid metal in liquid communication with the casting to feed it adequately whilst it was solidifying and give complete soundness.

A further desirable factor was that the top surface of the fluid reservoir (*i.e.*, feeder head) should also remain liquid and in communication with the atmosphere so that atmospheric pressure could assist the downward flow of metal into the casting. By supplying additional heat, in a sense, by artificial means, *i.e.*, by the use of an exothermic sleeve and top cover, it was easy to see that the large feeding heads previously necessary could be very considerably reduced, simply because although one was purposely providing a much smaller volume of metal it was maintained at a much higher temperature, and therefore most of it was available for feeding so long as the casting required it.

Other Implications

In order to take full advantage of such a method and to obtain a thoroughly sound casting it was also necessary, of course, to ensure that progressive solidification took place back to the feeding head or heads. If castings were uniform in section and symmetrical in shape, that might be comparatively easy; but the reverse was more usually the case, resulting in the rapid solidification of thin sections and prolonged slow setting in thick sections and hot spots at areas of heat concentration.

Another point, therefore, arose which it was worth while emphasizing. The Authors had very briefly mentioned and suggested the use of moulding methods incorporating materials of differing thermal conductivities, ranging from metal shot to highly-

insulating refractories, for the purpose of levelling out rates of setting. Mr. Logan said that in Institute discussions he had frequently mentioned his surprise that foundrymen did not avail themselves of, and experiment more with, such materials. For example, shaped slabs of foamed insulating plaster or bonded diatomaceous earth, and even moulded exothermic inserts, could be used to conserve or add heat in thin sections; or highly conducting materials such as silicon carbide, bonded chilled grit, shaped graphite blocks, or metal chills could be used to abstract heat from heavy sections and overheated areas.

He considered that this matter should be investigated more by practical foundrymen than hitherto, particularly as regards the necessity for progressive solidification. To give point to it, he recalled the paper on "Heat Transfer of Various Moulding Materials from Steel Castings," by Locket and Briggs, which was presented at the annual meeting of the American Foundrymen's Society in May, and which contained information capable of being utilized experimentally in the foundry. He commended this work to anyone who was interested in the conductivity of moulding materials.

Heat Loss from Open Feeders

Heat loss by radiation from feeder heads was dealt with in the Paper under discussion, and that was a point to which all foundrymen should pay attention. Every feeder head on every casting, whether assisted by exothermic means or not should be covered immediately after pouring, either with further suitable exothermic material or an efficient insulating material. The effect was further to conserve the heat of the feed metal and prevent the top surface from freezing over, thus ensuring atmospheric-pressure assistance. Attention to this point alone would improve the efficiency of any feeding arrangement and was well worth while.

The maximum efficiency of feeding would be obtained by using an exothermic sleeve and suitable exothermic top cover. However, the economics of the particular casting, in conjunction with the difficulty in obtaining soundness by ordinary foundry methods, cost of metal, etc., would decide what should be done in any individual case.

Dr. Atterton, after thanking Mr. Logan for his complimentary remarks, agreed that the paper by Briggs which he had mentioned was most valuable. However, with regard to the point that foundrymen were backward in experimenting with materials of various thermal conductivities, he pointed out that trials had certainly been made both in this country and abroad. Exothermic materials had certainly been used—in conjunction with a thin layer of fine facing sand—as a moulding material, where it was desirable to keep thin sections fluid and where it was necessary to lower the rate of cooling in particular casting sections.

About economics, as to whether one could afford to use exothermic materials, he said that one of the objects of the paper was to show that it was economic to use them. The Authors had hoped to illustrate, by means of the few random castings selected, that even on a direct costing basis, it was economic to use the sleeves. It was also shown in the Paper that, in addition to the direct saving, there were many indirect advantages, all of which should be considered. He hoped that in the discussion, some comment would be made on that aspect.

Very Low Yields

MR. A. P. RILEY referred to Dr. Ruddle's diagram of the casting of, he believed, a copper block, using a blind riser, and said this Table (Z) had shown that a blind riser was more efficient than one which was open-topped. On the other hand, in the Paper it was stated to be desirable to have atmospheric pressure acting on the open head. Also, in the Paper it was stated that ". . . in steel practice it is not uncommon to use heads of the order of 120 per cent. of the fettled weight of the casting." Mr. Riley suggested, however that that was very uncommon and that one had to be making very specialized castings to use that amount of heads; he would say that a proper figure was much nearer to 50 to 60 per cent.

Dr. Atterton, dealing with the question of blind risers, said that when employing blind risers in plaster, it was customary to have a small hole so that observation could be made to avoid over pouring; also the sleeves and covers were permeable, so that full atmospheric pressure would act upon the head. With regard to heads of the order of 120 per cent. of the weight of the fettled casting, this was certainly not a general rule, but the use of such large heads did occur. He drew attention to casting No. 1 in each of the Tables IV and V of the Paper. In Table IV, the finished casting weight was 160 lb. and the conventional feeder head weighed 150 lb.; thus, the head was about 95 per cent. of the casting weight. In Table V, the finished casting weight was 113 lb. and the head weighed 103 lb.; this was again over 90 per cent.

Survey of the Field

DR. C. J. DADSWELL (past-president) ventured to make some comments on the economics of the application of exothermic materials, although he did so, he said, without much authority and perhaps without much conviction. First, at the end of the section of the Paper headed "Thermit Mixtures," there was reference to the application of the Thermit type of mixture to large castings; and a further reference to that was made in a paper by Mr. S. Taylor, "Production of Heavy Steel Castings," where there was a diagram showing the period during the cooling down of a casting weighing 185 tons, when about 1 cwt. of the mixture was added to each head. The additions in that case were made on a very much larger scale than in the cases mentioned in the Paper under discussion. The additional mixtures were tipped in from a sack. That sort of thing was very haphazard and very empirical, and was generally done by guesswork when dealing with heads of 28- or 30-in. dia.

There was also reference to the use of Thermit

material in heads of large diameter which were usually kept open by arcing. The work done in that direction was very inconclusive. The method might be used in foundries using large electric furnaces, which were tapped perhaps only once in every four hours or more; but sometimes at a certain stage—which it was difficult to forecast unless one had made the same type of casting previously—the heads started to "run away," depending on the shape of the casting. However, the ability to add the exothermic mixtures when one perhaps had not an electric-melted charge ready did confer a feeling of safety, and it had been done on occasion. One of the problems in the arc heating of feeder heads was that a rather troublesome segregation occurred under the heads. Perhaps one might reduce that segregation by the addition of Thermit materials.

Expressing is interest in the comments made about the use of moulding materials for chills, Dr. Dadswell urged that there was a big future for study in that field. In the past foundrymen had tended to think of metal chills; the present Paper touched only the fringe of the subject; foundrymen were not sure about the rules and regulations, and the economics of using moulding materials of higher conductivity. He had seen in America the use of materials of that nature in connection with the mass-production of steel castings weighing about 1 ton each. Certain parts of those castings were difficult to chill, and the producers did not wish to use metal chills; therefore, they were using special refractory materials.

Obvious Economy

Whilst appreciating that the Authors' argument on the economics of the use of exothermic materials was true, Dr. Dadswell suggested they were wrong in saying that the value of steel in a finished casting was £80 to £100 per ton. He felt that they were worrying themselves unnecessarily by trying to prove something which was superfluous. If a 40 per cent. increase of yield could be achieved and the weight of feeders reduced by half, there was no need to prove much more. Working on the basis of the saving of steel in the ladle, alone would be sufficient. He agreed that there were other savings to be affected in fettling and so forth.

Warning

Recalling an experience which led him to strike a note of warning, he said that a very appreciable increase had been effected in the number of castings produced per ladle by using exothermic sleeves. Those concerned had thought that they were saving money. However, to show how empirical it all was, when the job was transferred to another steel foundry—which change meant using a slightly larger electric furnace with possibly some change in melting practice—trouble was experienced. There were many people in foundries who were not clever enough to control the various factors involved, and the trouble in that case may have been concerned with the temperature at which they were working.

He mentioned that as an instance of the belief that one of the factors which prevented ideas being developed rapidly was the feeling that it was necessary to proceed cautiously, because "the devil one knew was better than the devil one did not know."

DR. ATTERTON thanked Dr. Dadswell for his valuable comments; he agreed that the use of £80 to £100 per ton as the value of the saved head metal due to increased yield was open to question. He was rather puzzled about the diagram in the Paper by Mr. Taylor, to which Dr. Dadswell had referred. There was an addition of 1½ cwt. of Thermit mixture to each head and then 8 tons of feed metal was added to the casting. In what way was the metal added to the head after the use of the Thermit mixture?

When DR. DADSWELL said it was poured on top, DR. ATTERTON replied that it seemed to have been added straight through the slag layer.

DR. DADSWELL said he felt that the objectiveness of this additional feed metal was very doubtful.

THE CHAIRMAN (Mr. E. Longden), in thanking the Authors for their Paper, and all who had made comments and had put forward questions, said the members had enjoyed a remarkable discussion on a very modern development in the feeding of castings. All were indebted to Dr. Atterton also for the excellent way in which he had replied to the questions.

WRITTEN COMMENT

MR. A. PRINCE (University, Southampton) wrote that in a recent paper on "Thermit Casting" (FOUNDRY TRADE JOURNAL, 1954, **96**, 657) Steele quotes three typical metal melt compositions produced by Thermit methods. These include an 18/8-type Cr/Ni austenitic steel and a 1 per cent.-Mn steel. Dr. Atterton and Mr. Edmonds consider the Thermit process as being applicable to the plain carbon steels only, whereas it would appear that it could also be applied to alloy steels. If it is being used as Steele's paper demonstrates, for the production of alloy-steel castings, on the face of it there seems to be no basic reason for not applying the Thermit process to the problem of the riser with a view to producing hot metal of a similar composition to that of the casting. There may be adequate reason for the foundryman not pursuing this course and probably the Authors would like to comment on this matter.

The writer felt that the section of the Paper dealing with the mechanism of exothermic covers rather suffered because no indication was given of the constituents normally present in a typical cover mixture. He understands that the purpose of the refractory oxide is solely to act as a heat insulator, whilst the aluminium is oxidized and, thereby supplies the heat required in the riser. If the refractory oxide is not to be reduced by Al at the temperatures concerned, it would appear that this oxide must be more stable than Al_2O_3, *i.e.*, an alkaline-earth oxide. The oxidizing agent is not specified, but presumably powerful oxidizers such as $NaNO_3$ would be used. It would be very interesting for the writer to know whether he has grasped the point of the argument as he feels this

Theory, Economics and Practical Application of Exothermic Materials—Discussion

is perhaps the only part of the Paper which is not precise and clear.

DR. ATTERTON replied that as Mr. Prince pointed out, alloy steel may be produced by the use of correctly blended Thermit mixtures and the method had been employed for the feeding and the welding of steel castings. However, if the metal produced by the reaction entered into the casting, it was essential that it have an accurate composition. Consequently, raw materials of high purity and therefore expensive ones, must be employed. Due to the high cost, these "alloy" Thermit mixtures had gained little popularity for the feeding of castings and were not competitive with the exothermic-sleeve method.

On the question of the chemical composition of the exothermic material used for sleeves and covers, the material was designed so that the aluminium was oxidized both by oxygen liberated from powerful oxidizing agents, such as nitrates, and also atmospheric oxygen. The rate of burning was controlled by the use of metal halides, as mentioned in the Paper. The refractory filler was slightly less stable compared with alumina, but reduction by aluminium was negligible due to the physical grading of the material; in fact, it was a question more of chemical kinetics than thermodynamics.

Smoke Pollution at Stourport

Local Council may Prosecute

A Health Committee minute dealing with smoke pollution at Stourport was referred back for further discussion at a meeting of the Stourport Urban Council on October 6, when the possibility of taking court action against a local firm was mentioned.

It was reported that the sanitary inspector had visited the works of the Anglo-Enamelware Company, Limited, regarding the matter, and had inspected all the fuel-burning appliances likely to cause a nuisance. It appeared that the greatest nuisance occurred when a number of appliances were being fired by inexperienced stokers at infrequent intervals.

The sanitary inspector (Mr. G. Maddock) said that a bye-law permitted black smoke to be emitted for only three minutes in half-an-hour, and that had been exceeded by the firm on several occasions.

Councillor H. Prescott said the works was one of the worst places in the district and more smoke came from there than from the large power station.

The Health Committee will later decide whether to recommend that the firm be prosecuted.

Important Change of Address

The Ironfounders' National Confederation, the Midland Ironfounders' Association, and the National Foundry Craft Training Centre announce that their address is now Norwich Union Chambers, Congreve Street, Birmingham, 3. The new telephone number is CENtral 4391.

B.S.I. Information

The British Standards Institution *Information Sheet* for September lists under "Amendment Slips," B.S. 1349: 1947, Impact test for cast iron. Amendment No. 1 (Ref. No. P.D. 1960); and B.S. 2491: 1954, Domestic cooking apliances for use with butane/propane gases. Part I. Appliances for use with butane gas. Amendment No. 1 (Ref. No. P.D. 1946). B.S. 1452: 1948, Grey iron castings (3s.), temporarily out of stock, is now available again.

Listed under "Draft Standards Circulated For Comment" are C.T. 6791, Metal lavatory basins (revision of B.S. 1329); C.T. 6793, Cast iron spigot and socket soil, waste and ventilating pipes (revision of B.S. 416); C.T. 6794, Metal sinks (revision of B.S. 1244); C.T. 6795, Galvanized mild steel covers for cisterns (addendum to B.S. 417:1951), all 2s. (post free) to non-members.

New overseas standards available in the B.S.I. Library are, from South Africa: S.V. 100, Electrical equipment safety specification for general requirements for portable domestic and industrial electrical appliances; and from Spain: 43160, Protective goggles for fettlers. From South Africa, the Institution has received draft standards 15/11/10, Cast iron surface boxes and manhole covers with frames (revision of S.A.S.S. 67—1944); and 15/11/25, Doc 8 Cast iron fittings for asbestos cement pressure pipes.

Under "Water Fittings" the Institution has decided to make available all the current British Standards for Water Fittings at a special inclusive price. An unbound set of all the British Standards referred to in the 1954 Model Byelaws of the Ministry of Housing and Local Government, Series XXI, will cost £3 10s. 0d. (less 16⅔ per cent. to subscribing members) instead of the combined published price which amounts to £5 16s. 6d. Among the numbers and titles are the following:—40:1908, Cast-iron low-pressure heating pipes, spigot and socket; 78:1938, Cast-iron pipes (vertically cast) for water, gas and sewage and special castings for use therewith; 143: 1952, Malleable cast iron and cast copper-alloy pipe fittings for steam, air, water, gas and oil; 1211:1945, Centrifugally-cast ("spun") iron pipes; 1256: 1952, Malleable cast iron (whiteheart process) and cast copper-alloy pipe-fittings for steam, air, water, gas and oil.

"Allied" Group Changes

To mark an important change in the constitution of the Board, a dinner was given by the directors of M. Cockburn & Company, Limited, Falkirk, in the town recently. Mr. R. L. Hunter has relinquished his appointment as managing director of the company in order to take over a new appointment as managing director of the northern group of Allied Ironfounders, Limited, and Mr. D. McK. Webster, who for several years has been director and assistant general manager, has succeeded him. Mr. Hunter is continuing to serve as a director of the company.

The company, represented by senior members of the staff, had as its guests members of the Board of the northern group of Allied Ironfounders—Mr. G. Brand, Mr. A. D. Brown, and Mr. R. G. Sinclair. In the absence of Mr. W. H. Smith, chairman of M. Cockburn & Company, Limited, and of the northern Board, who is visiting Canada on business, Mr. R. L. Hunter presided, and referred to the progress of the firm during the last 30 years and mentioned some amusing incidents of past days. This year, incidentally, is also the company's 90th anniversary. In a concluding toast to the chairman, Mr. R. McMorland, Scottish sales representative, and a member of Cockburn's staff for 49 years, presented Mr. Hunter with two recent archaeological publications and a desk fountain-pen set as a memento of the occasion.

Notes from the Branches

Sheffield

Mr. Edward Ayres, foundry manager of Millspaugh Limited, engineers, Sheffield, was inducted as president of the Sheffield branch of the Institute of British Foundrymen on October 4. The installation dinner at the Arcade Cafe, Ecclesall Road, was attended by about 140 members. He presented a bronze bell to Mr. Michael Hallett, the retiring president, to be used for "gonging" makers of over-lengthy speeches at the branch's meetings. The bell is made of bronze from the scrapped ship H.M.S. Nelson. Mr. Ayres is the first president from a non-ferrous firm in the branch's 48 years' history, and in presenting the bell, he described it as "a non-ferrous present from a non-ferrous president."

Lancashire

Mr. E. Jackson (E. Jackson & Company (Manchester), Limited), the new president of the Lancashire branch at the opening meeting of the session said more and more mechanization had taken place in the last 15 years, bringing an increasing number of engineers into the foundry. To-day there were ferrous and non-ferrous die-casting plants producing millions of castings per year; then there was shell-moulding, which again did not require the skilled moulder, and, although still in its infancy, was producing hundreds of castings, all showing the tendency to "get away" from the older methods of moulding. It had to be remembered, however, he went on, that at the back of this huge output of castings, the skilled moulder stood supreme. He it was who made the large castings, the "one-off" castings, where no trials could be made—as could be done with die-casting and shell-moulding.

Unfortunately, the skilled moulder was all too often a man who, after his day's work, paid little attention to the technical side of his craft, unless he became a foreman. It was this type of individual, one who did not normally take a great deal of interest after working hours, that he was requesting to come forward, attend meetings, and help swell the membership of the Institute.

Scottish—North-eastern Section

At the opening meeting of the winter session of the Scottish North-eastern section at Arbroath, on October 5, Mr. D. S. Whyte, Dundee, the president, was introduced by the retiring president, Mr. H. Conacher. In his presidential address, Mr. Whyte described the efforts being made to keep the section alive and asked for more support from members and foundrymen in the area. Mr. J. Bell, this year's national president, pointed out the advantages of meetings and the opportunities they offered in helping to solve the many and varied problems of foundrymen. The Scottish branch president, Mr. Brown, from Edinburgh, also spoke. Mr. R. Leeks, Arbroath, secretary of the North Eastern section since its formation in 1951, was presented with a travelling rug by the president on behalf of the council members, in appreciation of the enthusiasm and high standard set by him during his term in office. Mr. Leeks has left the area to take up a position in Dunstable, as foundry manager. In his reply he expressed his regret at leaving Arbroath and the many friends he has made during his six years' stay in the town. He was employed by Shanks Ironfounders, Limited, and is

(*Continued at foot of col.* 2)

succeeded by Mr. D. Torbet who is also with the same company. Before the meeting, members of the Council and guests were entertained in the hotel. A film "They're Everywhere" sponsored by Glenfield & Kennedy, Limited, Kilmarnock, was shown during the evening.

Company News

WILLIAM SUGG & COMPANY, LIMITED, gas engineers and aluminium and non-ferrous founders, of London, S.W.1.—A one-for-one scrip issue, subject to C.I.C. consent, is announced by the directors.

ALQUIFE ORE COMPANY, LIMITED—A ninth payment has been received from Spain, amounting to £12,042, in connection with the sale of the subsidiary, Alquife Mines & Railway Company, Limited, for £500,000. This makes the total sum paid to date £413,898.

LIGHTALLOYS, LIMITED—For the year ended June 27 a final dividend is announced of 5d. per 5s. share to make a total of 6½d. a share, compared with 10½d. in the previous year. Profits fell from £31,476 to £17,065, before tax of £5,190, against £20,700 previously.

ALFRED HERBERT, LIMITED, machine-tool manufacturers, of Coventry—The company is paying a 2½ per cent. tax free interim. Last year the interim of 5 per cent., tax free, was followed by a final of 7½ per cent., tax free, accompanied by a two-for-one scrip issue.

STOTHERT & PITT, LIMITED—In the year to June 30, gross profits of the group advanced from £610,060 in 1952-53 to £727,135 in the past year, and net profits were up from £296,851 to £325,476. The ordinary dividend is maintained at 17½ per cent. on the capital as enlarged by last November's five-for-eight scrip issue.

MINWORTH METALS, LIMITED—A dividend is announced of 25 per cent. for the year to July 31, which compares with 20 per cent. previously. Subject to audit, the group trading profit is £40,616 compared with £43,527 in the previous year, before tax of £25,950 (£17,200). There are added provisions no longer required of £3,500 (£5,000). The 1952-53 group trading profit, before charging tax, included £17,500, which was part of a provision set aside in 1951 and no longer required.

POWER-GAS CORPORATION, LIMITED—The company announces that its subsidiaries' financial year will end on September 30 instead of June 30, thus being in line with the company's own year. Consequently the practice to hold a board meeting about the middle of December and the annual meeting in the following January will be discontinued. The board meeting, at which the dividend recommendation will be considered, will be held about February 10 next, and the annual meeting on or about March 24, 1955, immediately after which the dividend will be paid.

PARSONS MARINE STEAM TURBINE COMPANY, LIMITED—The company is raising its final dividend from 14½ to 17 per cent. to make 20 per cent. for the year to June 30, 1954, against 17½ per cent. in the previous year. It is proposed to capitalize £39,615 of capital reserve for a scrip issue of one-for-eight. After tax of £62,233, compared with £17,663 previously, net profit is £78,336 (£34,470). The chairman, Mr. G. L. Parsons, states that orders on hand are sufficient to keep the company employed during the current year, but there is a continued dearth of orders for new tonnage and unless some improvement occurs, the company will be working far below capacity in the year 1955-1956.

Personal

MR. A. J. BETTS has been appointed general sales manager of Enfield Cables, Limited.

MR. E. WATERWORTH, chief buyer since 1923 for the British Tyre & Rubber group of companies, has retired after more than 40 years' service.

MR. HERBERT RICHARD HOLMES, chief clerk at the South ironworks, has retired from the Appleby-Frodingham Steel Company Branch of the United Steel Companies, Limited. He joined the company at Scunthorpe in 1915.

MR. GEORGE DONALD WILSON, a director of Baker Perkins, Limited, engineers, of Peterborough, has been installed as president of Peterborough Engineering Society. He has been with the company and one of its predecessors since 1920.

MR. NORBERT EDWARD ROWE, technical director of Blackburn & General Aircraft, Limited, has been selected as president-elect of the Royal Aeronautical Society. He will take office as president at the annual meeting on May 5 next year.

MR. H. F. NORTH, Sheffield-branch engineer of the General Electric Company, has been appointed manager of the firm's Blackburn branch. He joined the firm as student apprentice in 1923, became branch engineer at Blackburn in 1936, and went to Sheffield in 1947.

CHAIRMAN and managing director of the Chillington Tool Company, of Wolverhampton, MR. H. W. HUNT, has received a presentation of a radiogram from the directors and staff at the works. The presentation was made by Mr. F. Gandy, the oldest employee at the works.

MR. J. L. RICE, B.Met., of the British Non-Ferrous Metals Research Association, who was appointed several months ago as shell-moulding advisor under the Advisory Service organized jointly with the Association of Bronze and Brass Founders, is now available for consultation.

MR. J. A. WALTERS, manager of the General Electric Company, Limited, special products department, has been appointed manager of the battery works at Witton in succession to MR. J. L. GOLDSMITH, who retired after 39 years with the firm. Mr. Walters joined the company in 1928.

MR. A. E. MILLARD, managing director of Walsall Conduits, Limited, completes 50 years' service with the firm this month (October) and on October 8 was the guest of honour at a dinner organized by his sales staff at which a presentation was made. Earlier Mr. Millard had received a silver tray and a set of cut glasses from his employees.

MR. J. W. ELLIOTT, C.B.E., chairman of Swan, Hunter & Wigham Richardson, Limited, has been re-elected president of the Shipbuilding Conference for the year 1954-55. SIR JAMES MCNEILL, deputy chairman and managing director of John Brown & Company (Clydebank), Limited, has also been re-elected as vice-president of the Conference.

MR. H. EVANS, Superintendent of the Development and Research laboratories of the Mond Nickel Company, Limited, at Birmingham, was installed as president of the Birmingham Metallurgical Society on October 7. His first official duty was to present the society's medal to his predecessor, Mr. G. Parkin, chief metallurgist at J. B. and S. Lees, Limited, West Bromwich, in recognition of his services to the Society in the past year.

DURING his visit to Australia, where he demonstrated the firm's range of shell-moulding equipment to foundrymen audiences in Melbourne, Sydney, Adelaide and Perth, MR. J. FALLOWS, technical director of Polygram Casting Company, Limited, was appointed an honorary member of the New South Wales branch of the Institute of Australian Foundrymen in recognition of his work. This distinction is of particular interest since it is the first honorary membership to be conferred.

COLVILLES LIMITED have appointed MR. W. BARR and MR. R. P. TOWNDREW, executive directors, to be directors of the company. Mr. Barr is chief metallurgist to the group. He is also president of the Institution of Metallurgists and honorary treasurer of the Iron & Steel Institute. Mr. Towndrew was until recently works manager of Clyde Iron Works. He has since assumed special responsibilities in connection with the organization of the construction of the new Ravenscraig Works, Motherwell. Etna Iron & Steel Company, Limited, the recently acquired Colvilles subsidiary, have appointed MR. R. MARSHALL and MR. S. THOMSON, of Colvilles Limited, to the Board. MR. J. KERR, senior, has resigned from the Board.

MR. WILLIAM HEPWORTH, chairman and managing director of Hepworth & Grandage, Limited, engineers, Bradford, retired on October 12 on his 70th birthday. He had received a presentation on the previous day on behalf of the directors, executives and employees. He joined the company, then E. Hepworth & Sons, when it started in 1907. On the formation of Hepworth & Grandage, Limited, in 1910 he became a founder director, and is the only surviving founder. MR. ELIJAH HEPWORTH, his younger brother, succeeds him as chairman and managing director, and becomes the third member of the family to hold the chairman's office. He joined the company as an apprentice in 1910, was elected to the Board in 1924, and became sales manager in 1928. From 1933 to 1953 he was secretary, and had latterly been sales director. MR. N. C. BREARLEY, a director since 1924, has been appointed deputy managing director and general works manager.

Obituary

MR. GEORGE CROSS, of Dore, Sheffield, proprietor of H. Shaw and Son, steel-magnet manufacturers of Monmouth Street, Sheffield, has died at the age of 67.

THE FUNERAL of Mr. Thomas Chambers Dawson, of Chapeltown, Sheffield, who died at the age of 76, and who had a life-long association with Newton Chambers & Company, Limited, took place on October 7.

AS BRIEFLY NOTED last week, the death took place on October 11 of MR. R. F. HUDSON, director and foundry manager of British Engines, Limited, of Newcastle-upon-Tyne. He was introduced into the foundry industry by his brother, Mr. Frank Hudson, when the latter was metallurgist with Glenfield & Kennedy, Limited. For a time, both were on the staff of the Fordath Engineering Company, Limited. Then the deceased joined the Phosphor Bronze Company, Limited, and during this period wrote his well-known text-book on non-ferrous foundry practice. When he returned to Newcastle, his native place, he took an active interest in the local branch of the Institute of British Foundrymen. Indeed, he was to have presided over the branch, a year or two ago, but illness prevented his acceptance of office. Though he suffered a serious head injury whilst at sea during his early youth, this in no way prevented him from leading a useful and active life, and the book to which reference has been made will long remain an eloquent testimony to his diligence and erudition.

SHELL MOULDING QUERIES
No. 6

On the question of ALUMINIUM BATCHES

A Shelmolda in action.

A medium size foundry firm wrote:—

"*We are advised that similar shell-moulded castings are being produced by a competitor, and if you are able to produce a satisfactory batch of 250 or 500 castings and can satisfy us that the machine is suitable for the work, it would be our intention to order one of your machines.*"

This is one of the many problems connected with shell mouldings with which we are dealing every day. We shall be pleased to advise you on the application of shell moulding in connection with your own particular product.

Shelmolda

The Shelmolda 'Duplus' has an output of 50 to 60 moulds per hour. It costs £575 and delivery is 8 to 10 weeks.

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News in Brief

CLEVELAND ironstone miners have agreed to the setting up of advisory committees at each mine to consider safety matters and the efficient working of the mines.

THE STAND of British Insulated Callender's Cables, Limited, at this year's "Minibition" of the Purchasing Officers' Association gained the premier award for attractiveness of layout and educational character of the exhibits.

A PHOTO-ELECTRIC CELL at the top of the chimneys of the Birmingham factory of the Austin Motor Company, Limited, will actuate an alarm bell in future as a warning to stokers if an excessive amount of smoke is emitted.

THE STEELWORKS of Voelkingen, in the Saar, owned by the Röchling family, have been offered for sale to the Schneider-Creuzot group. The works have a capacity of 870,000 tons of crude steel a year and employ 12,000 men.

THE CRUISER Shropshire is being towed 12,000 miles from Australia to Britain for breaking up. The Shropshire and the Dutch tug Oostzee left Sydney on October 11. The cruiser was commissioned in 1929 and presented to Australia in 1942 to replace the flagship Canberra, sunk in the Pacific.

THE SUNDERLAND engineering firm of Steel & Company, Limited, has set up a department for the employment of men 65 years old or over who wish to keep on working. The men of this age are to be employed on low quantity jobs, and the making of spares for experimental work.

A CONTRACT, which is still subject to ratification, has been signed between the Government of Haiti and the General Electric Company, Limited, for the provision of a new telephone, telegraph, and internal radio network throughout the country. It is worth approximately U.S. $2,250,000.

OWING to damage done by a fire which broke out at the foundry of Henry Bisseker, Limited, brassfounders, of Duddeston, Birmingham, on October 13, production was held up for some days. The foundry was in course of being reconstructed and it is thought that waste material from the old roof caught fire.

A MAN'S CLAIM for £150 damages against his employers, the Sheepbridge Equipment, Limited, of Chesterfield, was dismissed by Judge Sir Henry Braund at Chesterfield County Court on October 15, with costs for the defendant company. The case was fully reported in the JOURNAL of October 7, 1954, issue.

ACCORDING to a report from the *Bureau International de la Récupération* problems of cast-iron scrap were discussed at the recent general meeting in Paris, because the High Authority is to make a formal decision whether or not this material is to be included amongst the items falling within the competence of the common market.

BRITISH THOMSON-HOUSTON COMPANY, LIMITED, announce that to give greater service to customers in Nottingham and district, Mr. J. N. Griffiths, who has previously handled the electrical plant and apparatus business from B.T.H. Sheffield office, is now located in the Nottingham premises, 71-73, Lower Parliament Street (telephone: Nottingham 43588).

THE ANGLING TEAM from Hall & Pickles, Limited, Hydra Steel manufacturers, Ecclesfield, won the Parramore trophy in the inter-works angling competition at Sheffield. Greenside Foundry, Limited, Chapeltown, won the second team award, and the third was gained by W. Green & Company (Ecclesfield), Limited, ironfounders. Mr. G. Baguley won the special prize.

THE BRITISH ELECTRICITY AUTHORITY might start building its own atomic power station by 1958, according to Lord Citrine, chairman of the authority. If the experimental station at Calder proceeded satisfactorily, the B.E.A. might build atomic stations which by 1970 would generate enough electricity to make up for the deficit, an annual deficit of 20,000,000 tons of coal, which is expected about that time.

THE Auckland Harbour Bridge Authority has accepted a tender by Dorman, Long & Company, Limited, and the Cleveland Bridge & Engineering Company, Limited, to build Auckland's harbour bridge at a cost of £3,465,000. The contract is expected to be signed by the end of the month, when the other bodies concerned will give their approval. The bridge, which is to be 3,348 ft. long, is expected to be completed by the end of 1958.

THE QUEEN AND THE DUKE OF EDINBURGH will spend half an hour at the River Don works of English Steel Corporation when they visit Sheffield on October 27. They will witness a Siemens melting-furnace being tapped, and the forging of ingots made in the melting department. As they go through to the south machine-shop they will see a display of finished products. There will be opportunity for the Royal visitors to talk informally with the men.

E. BOYDELL & COMPANY, LIMITED, Old Trafford, Manchester 16, will be exhibiting the latest developments in their range of Diesel-engined bulk material handling equipment on stand 28 at the Public Works & Municipal Services congress and exhibition, Olympia, from November 15 to 20. Among the machines on display will be the Muir-Hill "Supalift" loader: a 10.5 cub. ft. small industrial hydraulic loader, the LH.1. and a 3 cub. yd. dumper, No. 10B.

AN ORDER from Argentina worth over £200,000 for the supply of mining plant and machinery, power plant, and machine tools for the lead-mining industry has been obtained by Black & Company (Buenos Aires), Limited, Among the principal suppliers are the General Electric Company, Limited, Fraser & Chalmers Engineering Works, Holman Bros., Limited, Uskside Engineering Company, Limited, and Associated British Oil Engines (Export), Limited.

ROBERT STEPHENSON & HAWTHORNS, LIMITED, Newcastle-upon-Tyne, have secured a contract worth £500,000 for 20 specially-designed locomotives for the New Zealand Government. A year's work will be provided by the contract. The first locomotive will be finished about February. The Newcastle works of the firm will make the chassis and mechanical parts, and the traction equipment and driving motors will be supplied by the English Electric Company, Limited.

TO CONVINCE the Finnish Government of its intention to sell British-made electric washing machines in that country the Darlaston firm of Wilkins & Mitchell, Limited, has had to build a new factory near Helsinki. Now the firm has surmounted a trade barrier with that country which banned all imports not having a Finnish content. "We have worked to get this trade for some years and our Finnish agents have been very co-operative," said Mr. Henry Wilkins, a director of the firm.

ABOUT 40 DELEGATES from all parts of the country attended the 32nd annual conference of the Women's Engineering Society in Birmingham from October 8 to 10. At the annual meeting, Miss Kathleen M. Cook,

(*Continued on page* 494)

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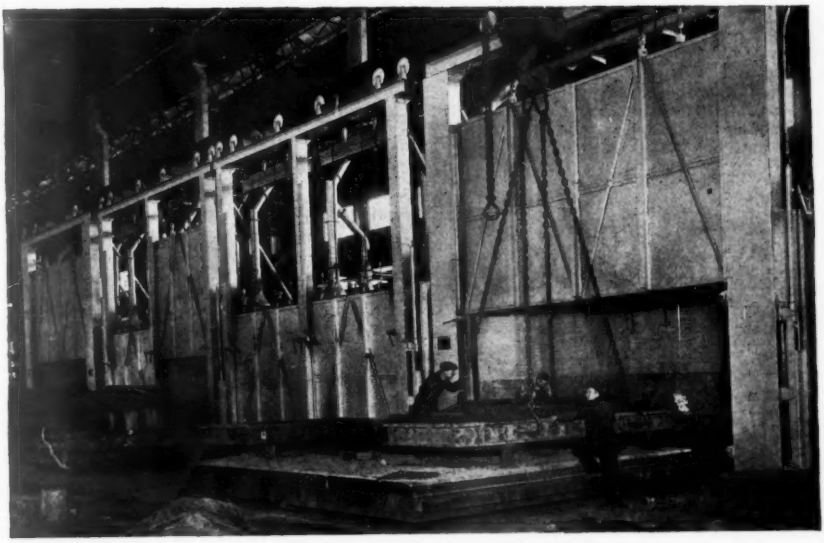

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Write for Illustrated Catalogue No. 103

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FT.9

News in Brief

(*Continued from page* 492)

senior vice-president was elected president of the Society in succession to Miss Dorothy Pile. During the conference, delegates visited the research laboratories of the Mond Nickel Company, Limited, and attended a reception and cocktail party at the Birmingham Exchange and Engineering Centre.

FOLLOWING their quarterly meeting, held in Leeds recently, chief generation engineers (construction) of the British Electricity Authority visited the Penistone works of the David Brown Foundries Company, one of the leading British suppliers of turbine casings for power stations at home and overseas. Several examples of this specialized work were seen by the engineers during their tour of the works, where they were received by Mr. G. L. Hancock, director and general manager of the David Brown foundry group.

DAVID BROWN MACHINE TOOLS, LIMITED, has received an order from Simca, the French motor manufacturers, for a "Hydrax" production gear hobber, a new high-speed, fully automatic machine designed primarily for the rapid production of automobile and commercial vehicle gears. Simca has also taken an option on two more of these machines, which weigh nearly 10 tons each. Several leading British automobile and commercial vehicle manufacturers have also placed orders for this machine. One company has ordered 16, and the total value of orders so far received is approximately £300,000.

IT HAS BEEN ANNOUNCED that a conditional contract has been signed by the David Brown Corporation of Huddersfield, for the purchase of the entire issued capital of Harrison, McGregor & Guest, agricultural engineers and manufacturers of agricultural machinery, for £200,000. The figure of 12s. per £1 preference and 4s. per £1 ordinary share has been agreed. The contract is conditional upon acceptance by the holders of 90 per cent. of each class of share, or such lower percentage in either case as the purchaser may consider adequate. Harrison, McGregor's preference dividend has been paid to January 1, 1948, only, and no ordinary dividend has been paid since 1947.

THE GAUGE AND TOOLMAKERS' ASSOCIATION is to take 1,000 square feet of space at the 1955 British Industries Fair at Castle Bromwich. The space will be used for a composite exhibit of the manufactures of about 40 member-firms of the association. The association has also announced that at a recent meeting of its council, the retiring officers were elected from 1954-55. Mr. F. W. Halliwell, president of the association, is chairman and managing director of Peter Brasshouse, Limited. of Birmingham. The chairman, Mr. A. L. Dennison, is chairman of the Birmingham Tool and Gauge Company, Limited, and Mr. S. J. Hartley, vice-chairman, is chairman of the Coventry Gauge and Tool Company, Limited.

TO HELP young workers, industry might well form a relationship with parents similar to the schools' parent/teacher associations, it was suggested in Birmingham last month at a conference organized by the West Midlands Group of the British Association for Commercial and Industrial Education, and entitled "Schoolboy to soldier; is the challenge being met?" Mr. T. A. Hamilton Baynes, chairman of Birmingham's Juvenile Court panel of magistrates, urged industrialists to do all they could to eliminate boredom from their factories. Young workers should have interests and hobbies and special clubs formed. Mr. D. J. Smith, headmaster of King Edward VI School, Stafford, told the conference that the boy leaving school now, educationally speaking, was about one year behind the boy who left in 1939.

PROF. A. M. ROBB, Professor of Naval Architecture at Glasgow University, in his presidential address to the Institution of Engineers and Shipbuilders in Scotland at Glasgow on October 5, referred to the problem of expanding the thrust and torque of a model propeller. He thought the treatment of that problem had not been satisfactory and that throughout all experimental work on model propellers there had been an error in principle. In conclusion, Prof. Robb said that the presentation, without any discussion of anomalies such as had been noted and of anomalies that had been apparent in experimental tank work for years, suggested a defect in the processes of technology. As apparatus became more and more complicated, attention seemed to focus on the apparatus rather than on the principles which should underlie the results.

"DEATH FROM MISADVENTURE" was the verdict returned by a jury at Wolverhampton on October 8 at an inquest on a labourer, Alfred Hughes, who was killed when a heavy weight struck him while the crane was being used in the breaking-up of scrap metal at the works of E. W. Wynn, Limited, ironfounders, of Bridgtown, near Cannock. The crane driver told the jury that he pressed the wrong button, causing the crane chain to shorten, and when the switch failed, a heavy connection fell on Hughes. Mr. R. Addenbrooke, works engineer, said that when the crane had its statutory check in May the switch was reported to be out of order, and he assumed that it would be rectified on the same day. He had no written evidence that it had been repaired, however. The jury added a rider expressing the hope that the firm would take adequate steps to maintain their crane switches in future.

INCLUDED among the exhibits at the "Ideas in Action" show at the Birmingham Museum of Science and Industry (which opened on October 1) is an ingenious machine which has been developed by the Printing, Packaging and Allied Traders' research laboratory to record the number and intensity of shocks received by a package in the course of a journey. The machine has been fully tested by road, rail, sea and air and is already in use in the Midlands. It is thought that it will be the means of saving hundreds of pounds in industry and commerce. Manufacturers will be able to estimate the probable hazards of a journey and to provide adequate packaging and conversely to detect cases of over-packing with a consequent saving of material. The exhibition aims at stimulating new ideas in production and is organized by the Birmingham Productivity Association in conjunction with the Department of Scientific and Industrial Research.

AT A MEETING convened by the National Union of Manufacturers in Birmingham on October 12, some 150 local manufacturers, faced with the eventual loss of their premises through the city's development scheme, decided upon a plan of building industrial "colonies"—up to 16 of them—along Birmingham's ring road. A "steering" committee was elected to work out practical details. It was suggested that each colony would contain between 10 and 40 firms. Mr. Ernest Holden, Midland area secretary of the N.U.M., told the meeting that the Birmingham Corporation had approved the idea and had promised to investigate the possibility of raising a loan to assist those industrialists who could not afford to build. It was stated that altogether some 700 manufacturers might be interested in the scheme and it was estimated that 31 per cent. of building costs could be saved by building "colonies" instead of separate factories. The scheme is believed to be the first of its kind in the country.

FOUNDRY FUMES???

Though corebinder developments have not yet reached the stage where it is possible to guarantee a complete absence of unpleasant casting odours, B.I.P.'s latest synthetic resin corebinder—Beetle W42—represents a very considerable advance in this direction. Developed with the Garrett Report in mind, it combines all the advantages of Beetle W20 with a reduction in casting odour that will be appreciated by foundrymen.

use* BEETLE RESIN W42* *for reduced casting odour

BIP GROUP

Write for technical information to British Industrial Plastics Limited,
Tat Bank House, Oldbury, Nr. Birmingham. London Office: 1 Argyll Street, W.1
'Beetle' is a trade mark registered in Great Britain and in most countries of the World.

**Patent Application 32896/58*

Raw Material Markets

Iron and Steel

Certain grades of foundry iron continue to be scarce, despite the fact that production has been stepped up by the introduction of new plant. Low- and medium-phosphorus iron is not available to cover all the current needs of the engineering and speciality foundries, many of which are adding to their production costs by using hematite. These foundries have heavy order-books, which include substantial business on export account. Jobbing foundries are mostly well employed, and they are able to acquire all the high-phosphorus iron needed for current orders, while deliveries to the light and textile foundries are also satisfactory. The light foundries are not too well placed, orders being only moderate, but there has been some improvement among the textile foundries.

Deliveries of scrap to the foundries are quite good, and there is sufficient coke for current usage. No difficulty is experienced in covering demands for ganister, limestone, and firebricks.

The demand for steel semis has been accentuated as the result of the improved call for small bars, light sections, strip, etc., and makers are fully committed for some time ahead. Re-rollers are anxious to augment their stocks of billets, although their existing stocks are quite substantial. It may indeed become necessary to import supplies of Continental steel semis.

Non-ferrous Metals

The setback in copper was carried further last week and, indeed, developed into something of a small slump, for the cash quotation was down by £30 and three months by £25. The backwardation narrowed from £20 to £15, but it is difficult to say whether this tendency will continue during the coming weeks. The New York Commodity Exchange followed the trend in London and the quotation was heavily marked down throughout the week. Buyers have laid off and very little business with consumers was reported last week. The industry still awaits news of the price at which Chile will market her copper, but, even though this may be as high as 35 cents, the chances of the U.S. producers' lifting their selling limit above 30 cents are remote. Copper strikes in North and South America are now settled, but there is some unrest in Rhodesia which might spread to the Copperbelt. There has been rather more business put through in scrap at prices which have varied from day to day.

Zinc lost 10s. for both positions last week, but continues to show a steady front on the whole. Lead was forced up to £111 on a technical squeeze, but dropped back to close at £107 15s., which was £2 5s. down for October and January lost £1 15s. Trading in tin was not very active, the close being £4 10s. down for cash, but only £2 10s. down for three months. At the close there was a contango of 10s.

Figures issued by the British Bureau of Non-Ferrous Metal Statistics show that August was a quiet month. In copper, consumption was 39,961 tons, against 42,417 tons in July, while stocks of refined copper, at 77,323 tons, showed a 10,000-ton advance on the total at the end of July. Zinc stocks, at 48,769 tons, on August 31 compared with 45,825 tons a month earlier. Consumption, all grades, in August was 22,102 tons, against 23,002 tons in July. In lead, stocks of refined metal, at 26,298 tons, were more than 3,000 tons down on the total of 29,492 tons at July 31. Tin consumption of 1,328 tons showed a drop of nearly 200 tons, but stocks at August 31 were 360 tons higher than at the end of July, when the figure was 3,823 tons. So far as can be seen, usage of non-ferrous metals should continue at a good rate to the end of the year, but fears about falls in prices may deter buyers.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* October 14, £275 to £276; October 15, £265 to £266; October 18, £257 10s. to £260; October 19, £267 10s. to £269; October 20, £262 10s. to £265.

Three Months: October 14, £260 to £261; October 15, £250 to £251; October 18, £247 to £247 10s.; October 19, £256 10s. to £257; October 20, £252 10s. to £253.

TIN, Standard—*Cash:* October 14, £733 to £734; October 15, £731 10s. to £732; October 18, £732 to £732 10s.; October 19, £730 10s. to £731; October 20, £729 to £730.

Three Months: October 14, £733 to £734; October 15, £732 to £733; October 18, £732 to £733; October 19, £731 to £732; October 20, £729 10s. to £730.

ZINC—*First half October:* October 14, £83 10s. to £83 15s. *Second half October:* October 15, £83 to £83 5s.; October 18, £82 to £82 5s.; October 19, £81 15s. to £82; October 20, £81 15s. to £82.

First half January: October 14, £83 10s. to £83 15s. *Second half January:* October 15, £83 to £83 5s.; October 18, £82 to £82 5s.; October 19, £81 10s. to £81 15s.; October 20, £81 5s. to £81 10s.

LEAD—*First half October:* October 14, £111 to £111 5s. *Second half October:* October 15, £107 10s. to £108; October 18, £106 10s. to £106 15s.; October 19, £106 15s. to £107 5s.; October 22, £107 to £107 10s.

First half January: October 14, £103 15s. to £104. *Second half January:* October 15, £102 10s. to £102 15s.; October 18, £101 10s. to £102; October 19, £101 15s. to £102; October 20, £101 10s. to £102.

Further Steel Output Records

LATEST steel output returns suggest that the industry may well attain the target for the year of 18,500,000 tons. The Iron and Steel Board announced on October 14 that production in September averaged 372,300 tons a week, which exceeded the previous best September weekly output, in 1953, of 346,500 tons. Production thus made a satisfactory recovery after the holiday period.

Steel output during the third quarter suffered from some exceptional interruptions to production in addition to the usual setback because of holidays. However, output during the first three quarters of the year was at a record annual rate of 18,320,000 tons, compared with 17,390,000 tons in the same period of last year.

Pig-iron production averaged 222,900 tons a week in September, the decline in output as compared with August being due to certain furnaces being out of commission for relining.

Latest steel and pig-iron output figures compare as follow with earlier returns:—

Period.	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
1954—July	211,200	10,984,000	263,100	13,682,000
August ..	227,400	11,823,000	325,600	16,932,000
September ..	222,900	11,591,000	372,300	19,358,000
3rd qtr. ..	220,700	11,476,000	324,300	16,865,000
1953—July	202,400	10,524,000	276,600	14,383,000
August ..	204,400	10,629,000	291,400	15,155,000
September ..	213,900	11,123,000	346,500	18,019,000
3rd qtr. ..	207,400	10,787,000	308,100	16,019,000

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The onslaught of the ocean can be likened to the white-hot molten metals in furnace and converter. And to the hand of the man who guides his ship is compared the controlling influence of Webcoline ramming refractory—each in its own way 100 *per cent. reliable.*

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WITHSTANDS ARDUOUS MELTING CONDITIONS

In the long run it more than pays to use a superior ramming refractory. What are the advantages of Webcoline? Greater mechanical strength at high temperatures; less volume change; simple and compact ramming; and a super quality that gives it an extra-tough 'skin' of high refractoriness. But, above all, Webcoline monolithic is renowned for its consistent dependability. However arduous your melting programme, you can plan for it with confidence.

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The superior lining for Steel Converters, Rotary Furnaces, Cupolas, etc.

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British steel speeds Toronto's traffic

ONE of the finest, quietest and cleanest subways in the world was opened in Toronto early this year. For the hundred cars to run on it, Toronto's Transport Manager travelled 11,000 miles seeing the best that America and Europe could offer. He chose British. Last year steel and goods made from steel accounted for 40% of our exports. The value was over one thousand million pounds.

Wherever there is steel there is British steel.

British steel leads the world

S.62 THE BRITISH IRON AND STEEL FEDERATION

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

October 20, 1954

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £14 19s. 6d.; Birmingham, £14 12s. 9d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £17 5s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £17 16s. 9d.

Scotch Iron.—No. 3 foundry, £17 9s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £18 19s. 6d.; South Zone, £19 2s. 0d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £19 19s. 6d.; South Zone, £20 2s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £17 14s. 6d.; Scotland (Scotch iron), £18 1s. 0d.; Sheffield, £18 19s. 0d.; Birmingham, £19 6s. 6d.; Wales (Welsh iron), £18 1s. 0d.

Basic Pig-iron.—£15 10s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots).—40/55 per cent., £42 0s. 0d., basis 45 per cent. Si, scale 17s. per unit; 70/84 per cent., £65 0s. 0d., basis 75 per cent. Si, scale 18s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. 0d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £185 0s. 0d. to £195 0s. 0d. per ton; 38/40 per cent., £251 0s. 0d. to £270 0s. 0d. per ton.

Ferro-tungsten.—80/85 per cent., 13s. 9d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 16s. 9d. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £75 0s. 0d. to £80 0s. 0d., basis 60 per cent. Cr, scale 25s. 0d. per unit; over 6 per cent. C, £74 0s. 0d. to £76 0s. 0d., basis 60 per cent. Cr, scale 24s. 0d. per unit; 2 per cent. C,* 1s. 7½d. per lb. Cr; 1 per cent. C,* 1s. 8d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. per lb. Cr; 0.10 per cent. C,* 1s. 9¾d. per lb. Cr; 0.06 per cent. C,* 1s. 10d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 6½d. to 7s. 1d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £225 0s. 0d. to £232 0s. 0d. per ton; 96/98 per cent., £255 0s. 0d. to £262 0s. 0d. per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 52s. 6d. to 70s. 0d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £54 15s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 12s. 6d.; tested, 0.08 to 0.25 per cent. C, £26 12s. 6d.; hard (0.41 to 0.60 per cent. C), £28 0s. 0d.; silico-manganese, £33 16s. 0d.; free-cutting, £28 16s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £32 12s. 0d.; silico-manganese, £34 17s. 6d.

* Average 68-70 per cent. Cr.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 16s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £30 16s. 0d.; acid, up to 0.25 per cent. C, £33 0s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £31 1s. 6d.; boiler plates (N.-E. Coast), £32 9s. 0d.; floor plates (N.-E. Coast), £32 10s. 6d.; sectional material, N.-E. Coast, £29 4s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £32 7s. 0d.; flats, 5 in. wide and under, £32 7s. 0d.; hoop and strip, £33 9s. 0d.; black sheets, 17/20 g., £42 1s. 0d.; galvanized corrugated sheets, 24 g., £51 8s. 6d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £53 8s. 0d.; nickel-chrome, £75 2s. 0d.; nickel-chrome-molybdenum, £84 13s. 6d.

NON-FERROUS METALS

Copper.—Cash, £262 10s. 0d. to £265 0s. 0d.; three months, £252 10s. 0d. to £253 0s. 0d.; settlement, £265 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 30¾d. per lb.; wire, 298s. 6d. per cwt. basis; 20 s.w.g., 329s. 9d. per cwt.

Tin.—Cash, £729 0s. 0d. to £730 0s. 0d.; three months, £729 10s. 0d. to £730 0s. 0d.; settlement, £730 0s. 0d.

Zinc.—Second half October, £81 15s. 0d. to £82 0s. 0d. second half January, £81 5s. 0d. to £81 10s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £112 10s. 0d.; rolled zinc (boiler plates), all English destinations, £110 5s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £96 0s. 0d.

Lead (Refined Pig).—Second half October, £107 0s. 0d. to £107 10s. 0d.; second half January, £101 10s. 0d. to £102 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 25d. per lb.; rods, drawn, 34½d.; sheets to 10 w.g., 278s. 9d. per cwt.; wire, 32½d.; rolled metal, 265s. 0d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £191; B6 (85/15), £245; BS249, £200.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £213; HTB2 (38 tons), £230; HTB3 (48 tons), £240.

Gunmetal.—RCH, 3/4 per cent. tin, — ; BS1400, LG2 (85/5/5/5), £240 ; LG3 (86/7/5/2), £251 ; G1 (88/10/2/½), £322; (88/10/2/1), £310.

Phosphor Bronze.—BS1400, PB1 (AID released), £330 per ton.

Phosphor Bronze Strip, etc.—Strip, 391s. 9d. per cwt.; sheets to 10 w.g., 414s. 3d. per cwt.; wire, 48¾d. per lb.; rods, 42½d.; tubes, 40¾d.; chill cast bars: solids 43d., cored 44d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 4d. per lb.; round wire, 10g. in coils (10 per cent.), 3s. 8½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 8¼d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £110 0s. 0d. Nickel, £483 0s. 0d. Aluminium, ingots, £156 0s. 0d.; aluminium bronze (BS1400), AB1, £281 ; AB2, £291. Solder, brazing, BS1845, 2s. 3d. lb.; granulated, 2s. 6d. lb.

Forthcoming Events

OCTOBER 25

A.B.B.F. Advisory Service

Manchester area:—"Shell Moulding," by J. L. Rice. 7.15 p.m. at the Engineers' Club, Albert Square, Manchester.

Institution of Production Engineers

Sheffield graduate section:—"Shell Moulding," by D. N. Buttrey, 6.30 p.m., at the Royal Victoria Station Hotel.

OCTOBER 26

Incorporated Plant Engineers

Southampton branch:—Visit at 5.30 p.m., to Folland Aircraft Limited, Hamble.

West and East Yorks branch:—"Heatless Repair of Broken Castings," 7.30 p.m., at Leeds University.

Institution of Production Engineers

Luton section:—"High-permeability Steel Castings for the Electrical Industry," by J. F. Hinsley, 7.15 p.m., in the Small Assembly Room, Luton Town Hall.

OCTOBER 27

A.B.B.F. Advisory Service

London area:—"Fuels, Especially Alternatives to Coke," introduced by Mr. L. Clegg and Mr. R. L. Robinson of the National Industrial Fuel Efficiency Service; 2 p.m. at the Clarendon Restaurant, Hammersmith (preceded by luncheon). Open to all interested foundrymen.

Institute of British Foundrymen

Birmingham, Coventry and West Midlands branch:—Lecture and film "Production of Heavy Steel Castings," by S. Taylor, 7.15 p.m., at the James Watt Memorial Institute, Great Charles Street, Birmingham, 3.

Institute of Fuel

North-Western section:—"American Fuel-research and the Work of the New Fuel-efficiency Service," by Dr. W. A. Macfarlane, 2.15 p.m., at the Engineers' Club, Albert Square, Manchester.

Purchasing Officers' Association

Tees-side branch:—Visit to John I. Hopper and Company Limited, Ropery, Thornaby-on-Tees.

OCTOBER 28

Institute of Fuel

Merseyside sub-section: "Shell Boilers," by A. D. C. Gunn, 7 p.m., at the Liverpool Engineering Society, 9, The Temple, Dale Street, Liverpool. Joint meeting with the National Smoke Abatement Society.

Purchasing Officers' Association

West of England branch:—Visit to Bristol Aeroplane Company, Limited, Engine Division, at 5.30 p.m.

OCTOBER 29

Incorporated Plant Engineers

Birmingham branch:—Films: "Oil in Industry," "Liquid Fuel in Industry," "Grease," and "Project 074," followed by discussion, 7.30 p.m., at the Imperial Hotel.

Institute of Physics

"Jet Engines and Non-destructive Testing," by W. G. Cook, 6.30 p.m., in the Lecture room of the Institute's house, 47, Belgrave Square, London, S.W.1.

OCTOBER 30

Institution of Production Engineers

Luton graduate section:—Visit to the De Havilland Engine Company, Limited, at Leavesden, Watford, Herts.

INTENDING PARTICIPANTS are reminded of the Joint Iron Council's annual convention and banquet, to be held in London on Tuesday, November 2. The convention will take place at the Connaught Rooms, Great Queen Street, Kingsway, W.C.2, at 2.30 p.m. The banquet will be at the Dorchester Hotel (entry by the Ballroom Entrance), Park Lane, W.1, at 6.45 for 7.30 p.m.

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CLASSIFIED ADVERTISEMENTS

PREPAID RATES: Twenty words for 5s. (minimum charge) and 2d. per word thereafter. Box Numbers 2s. extra (including postage of replies).

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House, 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Tuesday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

EXECUTIVE, specialising in Shot-blast Plant of the Impeller type, seeks similar position with a progressive firm desirous of widening its scope. Can bring the manufacturing and selling rights for G.B. and certain other countries of plant of advanced Continental design.—Box ES758, FOUNDRY TRADE JOURNAL.

MANAGER (45), fully experienced Foundry Manager, seeks really progressive position. Practical man; sales, commercial, technical control. Engineering, machine tool, jobbing, mechanised plant production; experimental work in shell process.—Box MF827, FOUNDRY TRADE JOURNAL.

FOUNDRY METALLURGIST (28), Metallurgy Diploma, Melbourne Technical College; 12 years' experience, latterly Chief Metallurgist Australian foundry in charge laboratory, cupolas, D.A. furnace and sand control. Two years' experience production S.G. iron. Arrives Britain October to gain further experience. Available for one year's employment. —Replies to Box FM760, FOUNDRY TRADE JOURNAL.

MECHANICAL and Electrical Foundry MAINTENANCE ENGINEER desires change, 40 years of age, life experience in Modern Plants Well versed on heavy plants, workshop supervision and developments, 15 years of Executive Experience. Box MA832, FOUNDRY TRADE JOURNAL.

METHODS ENGINEER, A.M.I.B.F., 14 years' supervision, seeks position. Practical foundryman, extensive experience mechanized and jobbing production. Thorough knowledge aluminium and bronzes. A.I.D. Time and Motion Study.—Box ME850, FOUNDRY TRADE JOURNAL.

PATTERNMAKER (35), A.M.I.B.F., at present employed in safe but dead-end job, seeks position where initiative is not frowned upon, preferably on foundry side. Twenty years' experience of wood and metal patternmaking of all types for floor and machine moulding. Sound practical experience of all foundry departments in the production of iron and non-ferrous castings. Jobbing foundry and mechanized plant. Willing to go anywhere, home or abroad, providing position offers scope for advancement on proven ability.—Box PA838, FOUNDRY TRADE JOURNAL.

FOUNDRY EXECUTIVE (31), 15 years' iron foundry experience, several years' executive experience. Qualified metallurgist, wide experience cupola, metal, sand and labour control. Sound practical training and progressive outlook. Accustomed full control, desires post where initiative, enthusiasm and integrity welcomed. West Midlands preferred or elsewhere if help forthcoming with accommodation. Please reply in confidence to Box FE853, FOUNDRY TRADE JOURNAL.

SITUATIONS WANTED—*contd.*

REPRESENTATIVE seeks similar position as Technical Sales with progressive company of foundry suppliers. Grammar school educated, full practical foundry experience, sand control, contacts Midlands and N. England, A.M.I.B.F.—Box RS842, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 *inclusive or a woman aged* 18-59 *inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order,* 1952.

PATTERNMAKER WORKING FOREMAN required. Thoroughly experienced all round man on Wood and Metal, a good estimator and checker, permanent position offered loyal, suitable man willing to work hard and long hours when necessary, and study his employers' interests first and foremost.—Write, stating in confidence full particulars of experience, etc., age, and wages received and required, also when available, Box PW812, FOUNDRY TRADE JOURNAL.

PATTERNMAKERS required, used to first-class Wood and Metal work. Excellent conditions, canteen, music while you work, etc., top wages and bonus, by the oldest (85 years) established firm, with the absolute highest reputation. Main suppliers for many years to all firms of importance in the entire country and the finest Plant and Equipment in the world.—Apply WRIGHT & PLATT, LTD., the World's Largest Engineering Patternmakers, Irving Street, Birmingham. Vacancies at Manchester branch. Apply Springfield Lane Works, Salford, 3.

WANTED.—Energetic man, about 30 years of age, with good education and engineering training, for the position of FOUNDRY PRODUCTION ASSISTANT. Applicants should hold a National Certificate or equivalent proof of technical education and ability, and should preferably have some knowledge of foundry work, though initiative and drive are regarded as the most important qualities.—Apply in own handwriting, giving details of experience to date and salary required, to: FOUNDRY ENGINEER, Morris Motors, Ltd., Nuffield Foundry, Wellingborough.

METHODS ENGINEER of Executive standing required by modern Steel Foundry. Experience in high alloy steels, shell moulding, etc., would be an advantage. Excellent prospects for right man and superannuation scheme in operation. Assistance with housing if required. —Write, stating age, experience and salary required, to PERSONNEL OFFICER, Sheepbridge Alloy Castings, Ltd., Hamilton Road, Sutton-in-Ashfield, Notts.

SITUATIONS VACANT—*contd.*

BRITISH TITAN PRODUCTS CO., LTD., has vacancies for GRADUATE CHEMISTS for applied Research in its Technical Sales Service Department at Billingham, County Durham.

Experience in the Ceramic or Vitreous Enamelling Industry essential.

Applicants should preferably be under 30 years of age. Conditions of work and service are very attractive, and there are Staff Bonus and Superannuation Schemes. Commencing salary dependent on age, qualifications and experience.

Application forms may be obtained from the PERSONNEL MANAGER, British Titan Products Co., Ltd., Kronos House, Coppergate, York.

CORE SHOP FOREMAN wanted for large Iron Foundry in Midlands. Preference will be shown for a man experienced in core blowing techniques. Staff appointment, pension scheme and good conditions of employment. Write giving full details to Box CS836, FOUNDRY TRADE JOURNAL.

SENIOR DESIGNER, experienced, for Gravity Die Casting production; good remuneration for right applicant. Write in first instance stating experience and when available. North London area.—Box SD847, FOUNDRY TRADE JOURNAL.

ALUMINIUM Ingot Manufacturer requires representative Midlands. Practical knowledge of foundry practice an advantage. Good salary and prospects. Write in confidence Box AI846, FOUNDRY TRADE JOURNAL.

FOREMAN required for bronze foundry producing castings up to 2 tons. Staff appointment with bonus on production. Apply in writing CHARLES CARR LTD., Grove Lane, Smethwick 40.

REQUIRED by old-established Foundry producing grey iron castings in South Staffordshire, an experienced man as FOUNDRY MANAGER to manage an up-to-date foundry and pattern-shops. Applicants should be between 35—45 and have a first class training and experience in foundry work of all classes and types, with ability to control labour and get results. The position is superannuated and carries a salary of not less than £1,500 per annum to a man capable of filling this job. Apply Box RB834, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN required for Blackheart Malleable Foundry in Midlands. Output 15 tons weekly. Must be fully conversant with all foundry practice. Full control given. State qualifications and salary required. Box FF833, FOUNDRY TRADE JOURNAL.

SENIOR PRODUCTION CONTROL CLERK required. Experience in machine loading for mechanised foundry desirable. Applicants must be capable of drawing up complete programmes and organising progress. Prospects of eventual control of section are envisaged. Commencing salary £575 per annum. Apply Personnel Manager, Box SP831, FOUNDRY TRADE JOURNAL.